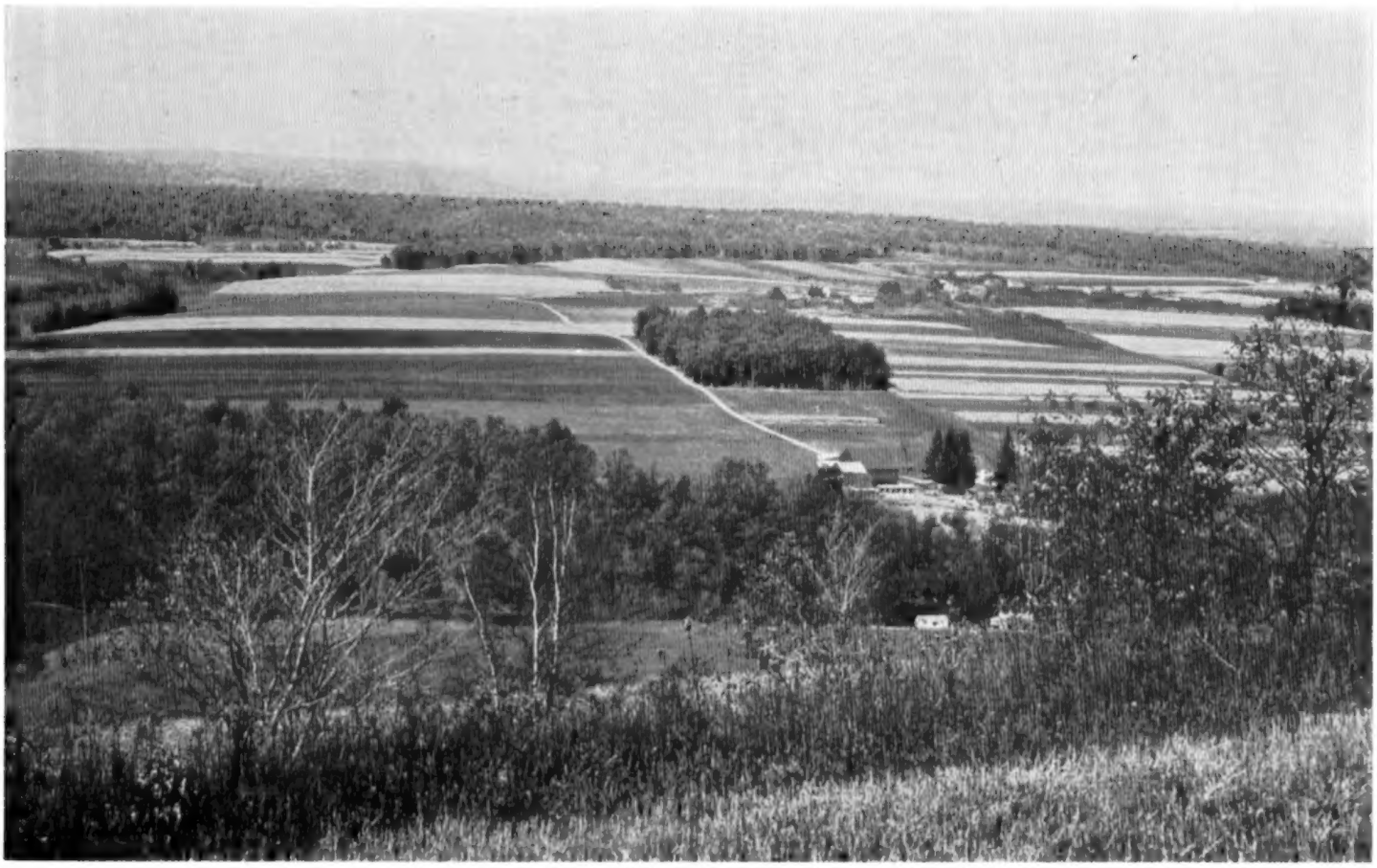
Series 1959, No. 14

Issued November 1962

SOIL SURVEY
CARBON COUNTY
Pennsylvania



UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
PENNSYLVANIA STATE UNIVERSITY
College of Agriculture and Experiment Station
and
PENNSYLVANIA DEPARTMENT OF AGRICULTURE
Soil Conservation Commission

HOW TO USE THE SOIL SURVEY REPORT

THIS SOIL SURVEY provides basic facts about the soils of Carbon County. These facts will increase our understanding of the land on which we live and our ability to work with nature. They will aid us in using the land most efficiently, in selecting the crops best suited to the soils, in using fertilizer, and in practicing soil and water conservation.

In making this survey, soil scientists walked over the fields and woodlands. They examined surface soils, subsoils, and parent materials; measured slopes with a hand level; noticed differences in growth of crops, weeds, and brush; and, in fact, recorded all the things about the soils that they believed might affect their suitability for farming, trees, wildlife, and related uses.

The scientists plotted the boundaries of the soils on aerial photographs. Then, cartographers prepared from the photographs the detailed soil map in the back of this report. Fields, woods, roads, streams, and many other landmarks can be seen on the map.

Locating the soils

Use the index to map sheets to locate your farm on the large map. The index is a small map of the county on which numbered rectangles have been drawn to show where each sheet of the large map is located. When the sheet of the large map is found on which your farm is located, it will be seen that boundaries of the soils are outlined, and that there is a symbol for each kind of soil. All areas marked with the same symbol are the same kind of soil, wherever they appear on the map. Suppose, for example, an area located on the map has the symbol Tf. The legend for the detailed map shows that this symbol identifies Tioga fine sandy loam. This soil and all others mapped in Carbon County are described in the section "Descriptions of the Soils."

Finding information

Special sections of the report will interest different groups of readers. The section "General Soil Areas" will be of interest mainly to those not familiar with the county.

Farmers and those who work with farmers can learn about the soils in the section "Descriptions of the Soils," and then turn to the section "Use and Management of the Soils." In this way they first identify the soils on their farm and then learn how the soils can be managed and what yields can be expected. The soils are grouped by capability units; that is, groups of soils that need similar management and respond in about the same way. For instance, in the section "Descriptions of the Soils" Tioga fine sandy loam is shown to be in capability unit I–1. The management this soil needs will be stated under the heading "Capability Unit I–1" in the section "Use and Management of the Soils."

Soil scientists will find information about how the soils are formed and how they were classified in the section "Formation and Classification of the Soils."

Engineers and others who use soils as a material in construction will find helpful information in the section "Engineering Properties of the Soils."

Students, teachers, and other users will find information about the soils and their management in various parts of the report, depending on their particular interest.

Technical assistance

The soil survey is not intended to be a source of all information needed for the successful operation of a farm in Carbon County. Information on crop varieties, fertilizers, soil conserving practices, and livestock management can be obtained from the county agricultural agent.

Farmers in Carbon County have organized the Carbon County Soil Conservation District. The district, through its officials, arranges for farmers to receive technical help from the Soil Conservation Service in planning good use and conservation of the soils on their farms. This soil survey is part of the technical assistance furnished to the Carbon County Soil Conservation District.

Specific conservation plans should be made for each farm. Assistance in the use or interpretation of information in this report is available from either the Soil Conservation Service or the Extension Service.

The "Guide to Mapping Units, Capability Units, and Woodland Suitability Groups" at the end of the report will simplify the use of the map and the report. This guide gives the map symbol for each soil, the name of the soil, the page on which the soil is described; the capability unit in which the soil has been placed, the page where the capability unit is described; the woodland suitability group into which the soil has been placed, and the page where the woodland suitability group is described. Soil survey and engineering terms are defined in the Glossary in the back of the report.

* * * * *

Fieldwork on the soil survey was completed in 1959. Unless explained otherwise, all statements refer to conditions at the time of survey.

Cover picture: The Hartleton-Allenwood soil association along Pohopoco Creek east of Lehighton. The ridges and steep slopes are Montevallo channery silt loam.

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Contents

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SOIL SURVEY OF CARBON COUNTY, PENNSYLVANIA

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UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE; IN COOPERATION WITH PENNSYLVANIA STATE UNIVERSITY COLLEGE OF AGRICULTURE AND EXPERIMENT STATION AND PENNSYLVANIA DEPARTMENT OF AGRICULTURE SOIL CONSERVATION COMMISSION

CARBON COUNTY is in the east-central part of Pennsylvania (fig. 1). It covers an area of 405 square miles, or 259,200 acres. The Lehigh River is part of the northern boundary, and Blue Mountain is the southern boundary. Jim Thorpe, the county seat, is on the Lehigh River. It is located north of Philadelphia, south of Scranton and northeast of Harrisburg.

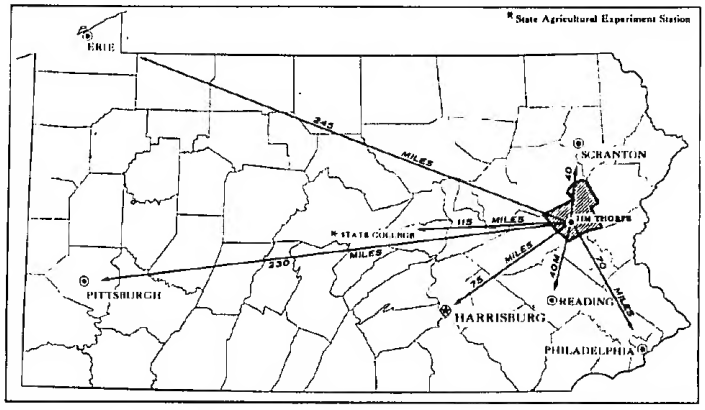

Figure 1.—Location of Carbon County in Pennsylvania.

Most of the county is in the Ridge and Valley province; the rest is the Pocono Plateau. About 86 percent of the county is wooded and is owned mainly in large tracts. Most of the farming is in the valleys, but a few farms are at an elevation above 1,400 feet. Dairying and the raising of poultry are the main types of agriculture; there are some livestock farms, and a few farms on which grain, potatoes, or fruit are the main sources of income.

Nature of the Soil Survey

Modern agriculture consists of a complex system of practices and management. It has been developed through trial and error by farmers and through research by workers at the State and Federal experiment stations. New ideas and methods cannot be tested on all soils, but workers at experimental farms have conducted field studies of crops, fertilizers, and farming methods on a few soils whose characteristics are known. The results of these studies can be applied to all the soils of a county if the characteristics of the soils in the county are known and are compared with those of the experimental soils. This detailed soil survey of Carbon County provides information for making such comparisons. By studying the characteristics of the soils described in this survey and comparing them to the characteristics of the experimental soils, the reader can predict the way in which Carbon County soils will respond to improved management.

In making the survey, soil scientists studied in detail the similarities and differences among the various soils in the county. Where necessary, they dug pits or bored holes with an auger so that they could study the characteristics of the soils in greater detail.

From the field examination, the scientist determined the color, texture, structure, consistence, drainage, reaction, and other characteristics that would enable him to map boundaries of soils on aerial photographs and to name and classify the soils. In addition, he obtained samples of the soils, which he sent for chemical and mechanical analyses to the soil laboratory at the Pennsylvania State University. These analyses helped to determine the properties of the soils for agriculture and for other uses.

When soils are named, a place name is given to each soil series. The name is usually that of a place near where the soils of that series were first described and mapped. All soils of a series are nearly alike in their characteristics, within defined limits, except for the texture of the surface soil. A soil type is named by giving the series name and the textural class of the surface soil, such as Hazleton loam. On a detailed soil map, most of the mapping units are phases of soil types, such as Hazleton loam, 0 to 3 percent slopes.

In contrast to the mapping units on a detailed soil map, the mapping units on the general soil map are associations of soil series. For example, one kind of association, or general soil area, is called the Hazleton-Drifton association. It consists of soils of the Hazleton and Drifton series and several minor soils. The grouping of the associated soil series is based on topographic position, parent material, slope, natural drainage, or other criteria. The twelve soil associations, or general soil areas, in Carbon County are described in the section that follows.

General Soil Areas

After studying the soils and the way they are arranged, it is possible to make a general map that shows the main patterns of soils. Such a map is the colored general soil map in the back of this report. The general soil areas are also called soil associations. Each kind of general soil area, or soil association, as a rule, contains a few major soils and several other minor soils, in a pattern that is characteristic, although not uniform. The soils within any one association are likely to differ greatly among themselves in some properties, for example, in slope, depth, stoniness, or natural drainage. Thus, the general soil map does not show the kind of soil at any particular place, but a pattern that has in it several kinds of different soils.

The general soil map is useful to people who want a general idea of the soils, who want to compare different parts of the county, or who want to know the possible location of good-sized areas suitable for a certain kind of farming or other land use.

1. Shallow to deep soils on gray glacial till: Lordstown-Swartswood association

Lordstown soils are dominant in this association and occupy about half the acreage. The Swartswood, Wurtsboro, and Volusia soils, together with the Lickdale and Tughill soils, make up most of the remainder. Nearly all of the association is very stony, but a few areas have been cleared and are farmed.

This association is nearly level to steep and is on the very slightly folded plateau. It is mainly in the western part of Kidder Township in the Pocono Mountain recreational area. This area was glaciated in recent geologic time.

The Lordstown soils are well drained and are shallow to moderately deep. They occupy the steepest parts of the area but also include some nearly level spots. The Lordstown soils are yellowish brown. On moderate slopes there are the deep, well-drained Swartswood soils, which have a hardpan at a depth of about 36 inches.

On the gentle slopes are the moderately well drained, yellowish-brown to strong-brown Wurtsboro soils, which have a hardpan and mottles at a depth of about 24 inches. The poorly drained Volusia soils are in the flat areas. Small areas of very poorly drained Lickdale and Tughill soils are in the depressions.

Most of this association is wooded and, because of the stoniness, will probably stay that way. Fires are somewhat of a hazard, and improved woodland management is needed. The present woodlands need thinning and consist of hard maple, white oak, aspen, gray birch, and sassafras.

Included in this association are areas of extremely stony land, along the Lehigh River, and bogs of Muck and Peat.

2. Moderately deep and deep soils on reddish-brown glacial till: Meckesville-Albrights association

The main soils in this association are the reddish-brown, well-drained Meckesville and the moderately well drained Albrights soils. The Albrights soils are mottled and have a moderate hardpan at a depth of about 24 inches. Other soils are the shallow to moderately deep Leck Kill, the poorly drained to somewhat poorly drained Morris, the very poorly drained Norwich, the shallow Klinesville, and the poorly drained Alvira and Shelmadine. Most of the association is mountainous and is wooded. The soils are stony, except for small areas that have been cleared.

The Klinesville and Leck Kill soils occupy ridgetops and steep slopes, and the Meckesville are on moderate to strong slopes. Below the Meckesville are the Albrights soils, which are nearly level to moderately sloping. The Morris soils are nearly level and are in positions below those occupied by the Albrights soils. The Norwich soils are in ponded areas and have a high water table. The Alvira and Shelmadine soils are at the heads of drainageways.

The soils in this association are better suited to trees and to recreational and wildlife areas than to other uses. The Pocono Mountain recreational areas are on these soils. Small areas of the Meckesville, Albrights, and Leck Kill soils have been cleared and are suitable for farming. Because of the high elevation, however, the growing season is short and early frosts are a hazard to corn and other crops. Pasture, hay, and other cool-season crops are suited to these soils. Because of destructive logging and fires in the past, the woodlands are poorly stocked with desirable trees.

Included in this association are small acreages of the Tunkhannock soils on outwash; areas of Very stony land on ridges bordering the Lehigh River and its tributaries; very narrow strips of Tioga and Middlebury soils; and small acreages of Muck and Peat in bogs and swamps.

3. Deep and moderately deep soils on gray glacial till and some shallow soils on sandstone: Hazleton-Drifton association

In most of this association, the soils are underlain by a deep layer of glacial till. In some places, however, the layer is only shallow to moderately deep.

The deep, well-drained Hazleton soils are the most extensive of the soils in this association. They have a yellowish-brown surface layer and a yellowish-brown to strong-brown subsoil. The Drifton soils, which are slightly thicker and darker and are moderately well drained, are next in extent. They have a light yellowish-brown, mottled subsoil. The well-drained Dekalb, together with the somewhat poorly drained Alvira, the poorly drained Shelmadine, and the very poorly drained Lickdale and Tughill soils, make up the rest of the association.

This association covers most of Penn Forest Township and Broad Mountain. The soils range from nearly level to steeply sloping. The Drifton soils are in slightly lower positions than the Hazleton. The Dekalb soils are on the steeply sloping border of the plateau and along the deeply cut stream valleys.

The elevation is high and the growing season is short in this general area. The soils are suited to tilled crops and pasture. Most of the acreage is wooded. There are few roads, and only a few persons live in the area the year round.

Included in this association are areas of Very stony land; small areas of Muck and Peat and alluvial soils; and some reddish soils.

4. Shallow to deep soils on glaciated, coarse sandstone and conglomerate: Fleetwood-Natalie association

This association is in the coalfields and also along Stony Ridge in the southeastern part of county. The dominant

soils are the well-drained, deep and shallow Fleetwood. Minor ones are the moderately well drained Natalie and the poorly drained Andover soils. The Natalie soil has a mottled subsoil that overlies a moderate hardpan. The pan is at a depth of 19 to 27 inches. The Andover soil has a thin, black surface layer, a mottled subsurface layer, and a gray subsoil resulting from a high water table. The Natalie and Andover soils are in lower positions than the Fleetwood and obtain some of their moisture through runoff from those soils.

Most of this association is wooded, but a small acreage of Fleetwood soils has been cleared for farming. If enough lime and fertilizer are applied to lower the acidity and improve the fertility, the soils are suited to most crops. The uncleared part is very stony and is suited only to trees.

Included in this association are areas of Made land, Strip mines, and Very stony land.

5. Soils on colluvium along the bases of steep mountains: Laidig-Buchanan association

The Laidig and Buchanan soils are dominant in this association. These soils have developed in colluvium that weathered from acid, gray and red sandstone, siltstone, shale, and conglomerate. The soils of both series are medium textured and have coarse fragments in the profile. The Laidig soils are deep, are well drained, and have a moderate hardpan at a depth of about 36 inches. The Buchanan are moderately well drained and have a thin, mottled layer over a hardpan at a depth of about 24 inches. The Andover soils are minor. They are poorly drained to very poorly drained and have gleyed horizons in the profile.

Some of the cleared areas in this association are farmed, but most of the acreage is stony and is wooded. Because of their topographic position and the impervious horizon in the profile, the soils are poor for crops unless practices are used to dispose of excess surface water.

Included in this association are areas of Leck Kill and Meckesville soils, which were formed from reddish parent material and lack a hardpan. Also included are small areas of poorly drained Shelmadine on upland flats and the Middlebury, Holly, and Papakating soils on flood plains.

6. Shallow to deep soils on glaciated, gray siltstone, shale, and fine sandstone: Montevallo-Hartleton association

The main soils in this association are the shallow, well-drained Montevallo, which consist of 6 to 18 inches of dark yellowish-brown channery silt loam over shattered bedrock. The other extensive soils are the deep, well-drained Hartleton. The Hartleton soils have a subsoil that is slightly heavier textured than the surface layer and a C horizon that is at a depth of 36 inches or more. In addition, there are small areas of Middlebury soils along small streams.

This is the largest association in the southern part of the county. It occupies the northern parts of East Penn and Lower Towamensing Townships and most of Mahoning, Franklin, and Towamensing Townships. About 33 percent of the acreage is Hartleton channery silt loam, which has slopes of less than 15 percent, where the softer shale is common. The Montevallo soils occur where the harder shale, siltstone, and thin-bedded sandstone predominate, even in level areas. About 25 percent of the association, and the highest part, consists of irregular flats between watersheds. In the rest of the association, most of the soils have slopes of more than 15 percent.

More than half of this association has been cleared and farmed. Now, many areas of the steeply sloping soils and a few areas of the gently sloping ones are no longer in cultivation. Most of the steep areas of Montevallo soils have been planted to pine. Many pine plantations are in the southern part of the county.

7. Deep soils from glacial till of varying age and mixture: Hartleton-Allenwood association

The deep, well-drained Hartleton and Allenwood soils are dominant in this association. The moderately well drained Watson and Comly soils, the somewhat poorly drained Alvira, and the poorly drained Shelmadine are minor (fig. 2). These soils have formed from glacial till that was deposited on low shale ridges. The till was derived partly from gray shale, but it also includes materials from fine sandstone, siltstone, and other shale. The Allenwood and Watson soils have formed from a yellowish-red material that weathered from sandstone, siltstone, shale, and conglomerate.

Figure 2.—**An area consisting of the Hartleton, Comly, Alvira, and Shelmadine soils. The wooded ridges are Klinesville soils. Location: Along U.S. Highway No. 209, east of Lehighton.**

This association is mainly in the Big Creek and Mahoning Valleys. Most of it is moderately sloping, except for short, strong slopes on the borders of drainageways and streams. The Montevallo soils have steep slopes and small areas of rock outcrop.

This association is among the best agricultural areas in the county. Most of it is in crops or pasture, but part is in townsites and homesteads. Most of the soils are well suited to locally grown crops and to pasture.

Included in this general soil area are alluvial soils along streams; moderately well drained Middlebury soils; and poorly drained Holly soils.

8. Soils on shallow to deep, reddish siltstone and fine sandstone: Allenwood-Watson-Klinesville association

The main soils in this association are the deep, well drained Allenwood; the deep, moderately well drained Watson; and the shallow, well drained Klinesville (fig.3).

Figure 3.—**The Spring Mountain syncline containing coal measures, located about 2 miles southeast of Beaver Meadows. Allenwood soils are in the foreground. The slopes in the center are Watson silt loam. The mountainous slopes in the background are occupied by Klinesville and Dekalb soils and Fleetwood, shallow, stony soils.**

Other soils are the well-drained, moderately deep Leck Kill; the deep, somewhat poorly drained Alvira; the poorly drained Shelmadine; and the very poorly drained Norwich. The Middlebury, Holly, and Papakating, which have formed in alluvium, are minor soils (fig. 4).

This association occupies low ridges, mainly in the Weatherly and Quakake Valleys. Smaller areas occur where the red beds are exposed. The Klinesville soils are only 6 to 18 inches deep and have formed on the narrow high ridges and steep side slopes the Leck Kill soils are 6 to 12 inches deeper than the Klinesville. The Watson soils are mottled below a depth of about 24 inches and occupy the lower slopes. The Alvira, Shelmadine, and Norwich are the least extensive important soils.

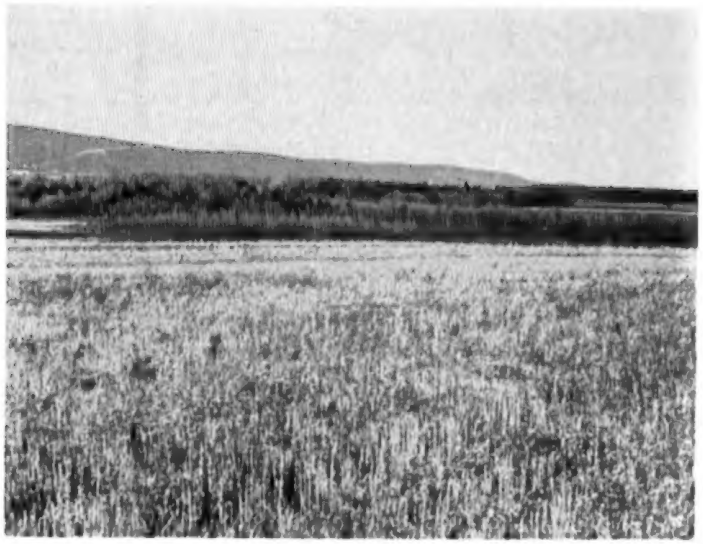

Figure 4.—**Soils in association 8. Allenwood soils are in the foreground. In the right center are the Leck Kill soils. Papakating soils occupy the swampy flood plain. The distant mountains are the Klinesville and Dekalb soils.**

This association is among the best agricultural areas in Carbon County, and most of it is in farms. The Klinesville soils, however, are not well suited to crops. The soils in this association contain varying amounts of gravel and channery fragments, which are least abundant in the Watson, Alvira, and Shelmadine soils. Frost is a hazard in some years. Erosion is a serious problem.

9. Deep soils on glacial outwash derived from gray and red rocks: Tunkhannock-Conotton association

This association consists mainly of the Tunkhannock and Conotton soils. The reddish-brown, medium- to coarse-textured Tunkhannock soils are on the edge of the Wisconsin glacial drift in Kidder, Penn Forest, and Lehigh Townships. They are on kames, valley trains, and deltas. The dark-brown, nearly level Conotton soils have developed on stream terraces and outwash plains a distance from the glacial boundary. They are near Normal Square and Ashfield and along Aquashicola Creek.

The Conotton soils are mostly in cultivation. Except for the tendency to be droughty and for the coarse fragments that interfere with tillage, they are well suited to deep-rooted crops and to most other crops that are grown in the county. The complex slopes of the Tunkhannock soils are mostly in trees. These soils are used as sources of sand and gravel.

Included in this association with the Tunkhannock soils are small areas of very poorly drained soils and spots of Muck and Peat. In addition, moderately well drained Middlebury and poorly drained Holly soils are on narrow flood plains.

10. Steep, stony soils on frost-worked, gray sandstone and deep glacial till: Dekalb-Hazleton steep soils association

The well-drained, shallow to moderately deep Dekalb soils are dominant in this association. They are mainly stony and are dominantly medium-textured loams, but their texture ranges from sandy loam to silt loam. The deep, well-drained Hazleton soils are less extensive and occupy moderate to moderately steep slopes. They have a medium-textured surface layer and a subsoil that is heavier textured than the surface layer.

Trees cover this entire association and provide watershed protection. Fires are the main problem.

Included with this association are stony Klinesville and shallow Fleetwood soils. These soils occur where red shale outcrops on the lower parts of steep slopes and on the tops of mountains rimmed with conglomerate. Also included are extremely stony areas and a few areas of somewhat poorly drained Alvira soils.

11. Shallow to moderately deep soils on glaciated, red and brown siltstone and shale: Klinesville-Leck Kill association

Nearly all of this association is on the red shale ridges south of Jim Thorpe, the county seat. The soils are in long, narrow areas parallel to the major valleys. The Klinesville soils are 6 to 18 inches thick, are underlain by shattered bedrock, and have a profile of red channery silt loam. They are steeper than the Leck Kill soils. The Leck Kill soils are 18 to 30 inches thick and are fairly uniform in texture. In most areas they have formed in moderately sloping beds of softer shale. Narrow bands of the Middlebury soils are along small streams.

Much of this association has been farmed, but most of it is now idle or has been planted to trees. As a whole, the soils are better suited to grassland farming than to cultivated crops because they are droughty and shallow. The Leck Kill soils are more desirable than the other soils for agriculture, but they tend to be droughty. Erosion is a serious problem because the soils are shallow.

12. Miscellaneous land types association

In this association are areas of Very stony land; Mine dumps; Mine dumps, coal; Riverwash; Riverwash, coal; and Made land. These land types are generally unsuited to agriculture. They may be unsuitable for forestry because of stoniness or rock outcrops, or because they consist of refuse. Some areas, however, can be revegetated to provide protection from erosion.

Use and Management of the Soils

This section is in four parts. The first explains how soils are grouped according to their capability. The second describes the capability units and provides estimates of relative yields that can be obtained from each soil under two levels of management. The third deals with interpretations for woodland, and the fourth, with engineering properties.

Land Capability Classification

The capability classification is a grouping of soils that shows, in a general way, how suitable they are for most kinds of farming. It is a practical grouping based on limitations of the soils, the risk of damage when they are used, and the way they respond to treatment.

In this system all the kinds of soil are grouped at three levels, the capability class, subclass, and unit. The eight capability classes in the broadest grouping are designated by Roman numerals I through VIII. In class I are the soils that have few limitations, the widest range of use, and the least risk of damage when they are used. The soils in the other classes have progressively greater natural limitations. In class VIII are soils and landforms so rough, shallow, or otherwise limited that they do not produce worthwhile yields of crops, grazing, or wood products.

The subclasses indicate major kinds of limitations within the classes. Within most of the classes there can be up to four subclasses. The subclass is indicated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* means that water in or on the soil will interfere with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the country, indicates that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few or no limitations. Class V can contain, at the most, only subclasses *w*, *s*, and *c*, because the soils in it have little or no erosion hazard but have other limitations that limit their use largely to pasture, range, woodland, or wildlife.

Within the subclasses are the capability units, groups of soils enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping of soils for many statements about their management. Capability units are generally identified by numbers assigned locally, for example, IIe–1 or IIIe–2.

Soils are classified in capability classes, subclasses, and units in accordance with the degree and kind of their permanent limitations; but without consideration of major and generally expensive landforming that would change the slope, depth, or other characteristics of the soil; and without consideration of possible, but unlikely, major reclamation projects.

For the purpose of discussing general agricultural management, the soils of Carbon County have been grouped into eight capability classes, numerous subclasses, depending on the kind of limitation, and 33 capability units. The drainage referred to is the natural drainage of the soil.

Class I. Soils that have few limitations that restrict their use.

(No subclasses.)

Capability unit I–1: Deep, well-drained, medium textured to moderately coarse textured soils on flood plains.

Capability unit I–2: Deep, well-drained, nearly level, medium-textured soils on uplands.

Class II. Soils that have some limitations that reduce the choice of plants or require moderate conservation practices.

Subclass IIe.—Soils subject to moderate erosion if they are not protected.

Capability unit IIe–1: Deep, loamy, well-drained, gently sloping soils.

Capability unit IIe–2: Deep, friable, well-drained, gently sloping soils that have a firm horizon in the subsoil.

Capability unit IIe–3: Moderately deep, loamy, well-drained, gently sloping soils.

Capability unit IIe–4: Deep to moderately deep, moderately well drained, gently sloping soils.

Subclass IIw.—Soils that have moderate limitations because of excess water.

Capability unit IIw–1: Deep, moderately well drained, level to gently sloping soils.

Capability unit IIw–2: Deep to moderately deep, moderately well drained to somewhat poorly drained, nearly level, medium-textured soils.

Subclass IIs.—Soils that have moderate limitations of moisture capacity or tilth.

Capability unit IIs–1: Moderately deep to deep, medium-textured, nearly level soils.

Class III. Soils that have severe limitations that reduce the choice of plants, or require special conservation practices, or both.

Subclass IIIe.—Soils subject to severe erosion if they are cultivated and not protected.

Capability unit IIIe–1: Deep, well-drained, loamy soils.

Capability unit IIIe–2: Deep, well-drained soils with a firm subsoil horizon.
Capability unit IIIe–3: Moderately deep to deep, well-drained soils.
Capability unit IIIe–4: Shallow, well-drained, loamy, nearly level to gently sloping soils.
Capability unit IIIe–5: Deep to moderately deep, moderately well drained soils that have a pan at a depth of 18 to 24 inches.

Subclass IIIw.—Soils that have severe limitations because of excess water.
Capability unit IIIw–1: Somewhat poorly drained and poorly drained soils with tight, slowly permeable subsoil.

Class IV. Soils that have very severe limitations that restrict the choice of plants, require careful management, or both.

Subclass IVe.—Soils subject to very severe erosion if they are cultivated and not protected.
Capability unit IVe–1: Well-drained, medium-textured, mostly severely eroded soils.
Capability unit IVe–2: Moderately deep soils on glaciated or frost-worked residuum.
Capability unit IVe–3: Shallow, well-drained soils over siltstone and shale.
Capability unit IVe–4: Moderately well drained, severely eroded soils.

Subclass IVw.—Soils that have severe limitations for cultivation because of excess water.
Capability unit IVw–1: Nearly level to gently sloping, poorly drained soils that have tight, slowly permeable subsoil.

Class V. Soils that have little or no erosion hazard, but that have other limitations that are impractical to remove that limit their use largely to pasture, range, woodland, or wildlife food and cover.

Subclass Vw.—Soils too wet for cultivation; drainage or protection not feasible.
Capability unit Vw–1: Very poorly drained soils in depressions and soils having a perched water table.

Class VI. Soils that have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife food and cover.

Subclass VIe.—Soils severely limited, chiefly by risk of erosion if protective cover is not maintained.
Capability unit VIe–1: Deep, well-drained, moderately steep soils that are severely eroded.
Capability unit VIe–2: Shallow to moderately deep, rapidly permeable, moderately sloping to moderately steep soils.

Subcass VIw.—Soils severely limited by excess water and generally unsuitable for cultivation.
Capability unit VIw–1: Poorly drained to very poorly drained soils on flood plains subject to overflow.

Subclass VIs.—Soils generally unsuitable for cultivation and limited for other uses by their moisture capacity, stones, or other features.
Capability unit VIs–1: Deep, well-drained, very stony, nearly level to moderately steep soils.
Capability unit VIs–2: Shallow to moderately deep, very stony, nearly level to moderately steep soils.
Capability unit VIs–3: Moderately well drained, very stony, nearly level to moderately steep soils.
Capability unit VIs–4: Somewhat poorly drained to poorly drained, very stony, level to gently sloping soils.

Class VII. Soils that have very severe limitations that make them unsuited to cultivation and that restrict their use largely to grazing, woodland, or wildlife.

Subclass VIIe.—Soils very severely limited, chiefly by risk of erosion if protective cover is not maintained.
Capability unit VIIe–1: Shallow, droughty, steep to very steep soils.

Subclass VIIw.—Soils very severely limited by excess water.
Capability unit VIIw–1: Organic soils with a permanent high water table.

Subclass VIIs.—Soils very severely limited by moisture capacity, stones, or other soil features.
Capability unit VIIs–1: Deep, poorly drained and very poorly drained, very stony, level to very gently sloping soils.
Capability unit VIIs–2: Very poorly drained, very stony soils in swamps and depressions.
Capability unit VIIs–3: Shallow, very stony, steep to very steep soils.

Class VIII. Soils and landforms that have limitations that preclude their use for commercial plant production and restrict their use to recreation, wildlife, water supply, and esthetic purposes.

Subclass VIIIs.—Rock or soil materials that have little potential for production of vegetation.
Capability unit VIIIs–1: Stony, steep, or unmanageable areas having no continuous mantle of soil.

Management by Capability Units

The capability units are described in this section and the use and management of each unit is discussed.

CAPABILITY UNIT I–1

This unit is made up of deep, well-drained, medium textured to moderately coarse textured soils on flood plains. The soils have developed in alluvium, and they are friable and easily worked. Productivity is moderate, and the response to fertilization is good. The capacity for holding available moisture is moderate to high. Floods occasionally cover the soil and leave fresh sediment. The soils in this unit are:

Tioga fine sandy loam.
Tioga silt loam.

These soils are well suited to all the crops commonly grown in the county. The main practices that are needed to protect them from erosion and to maintain good tilth are growing crops in rotation and keeping the soils under a cover crop in winter. Lime and fertilizer should be applied according to the results of soil tests and the kind of crop to be grown.

CAPABILITY UNIT I-2

The soils in this unit have developed on uplands and terraces in glacial drift. They are deep, well drained, and nearly level. The soils are friable, have good structure, and hold moisture well. Their subsoils are permeable to roots. The Fleetwood and Tunkhannock soils are more permeable than the others and have slightly less capacity for holding moisture. The response to fertilization is good. The soils in this unit are:

Allenwood gravelly loam and silt loam, 0 to 3 percent slopes.
Allenwood gravelly silt loam, 0 to 3 percent slopes.
Fleetwood sandy loam, 0 to 3 percent slopes.
Hazleton loam, 0 to 3 percent slopes.
Meckesville channery loam, 0 to 3 percent slopes.
Tunkhannock gravelly loam, 0 to 3 percent slopes.

These soils are well suited to all of the crops grown in the county. Good yields can be expected from small grains, corn, potatoes, and hay and pasture. Frost in the mountainous areas, however, may interfere with the maturing of crops and may thus reduce the yields.

The cropping system should include hay grown at least 1 year in every 4 years. A winter cover crop needs to be grown after corn and other clean-tilled crops have been harvested. The organic matter provided by forage and cover crops helps to maintain an open, porous structure in the soils. Keeping the soils open and porous is the main problem in managing these soils.

Lime to reduce acidity and fertilizer to maintain productivity should be applied according to the results of soil tests and the kind of crop to be grown. The plowing down of lime and fertilizer encourages roots to penetrate the subsoil more deeply. Contour cultivation may be needed in some fields to reduce runoff and prevent erosion.

CAPABILITY UNIT IIe-1

The soils in this unit are gently sloping and are deep, well drained, and friable. They are permeable to moisture and roots. Supplies of available moisture for plants are moderate to high. The Fleetwood, Conotton, and Tunkhannock soils are more permeable than the others and are slightly less capable of holding moisture for plants. The soils are acid, but with lime and fertilizer they are productive. Some of them have lost half or more than half of the original surface layer through erosion. The soils in this unit are:

Allenwood gravelly loam and silt loam, 3 to 8 percent slopes, moderately eroded.
Allenwood gravelly silt loam, 3 to 8 percent slopes, moderately eroded.
Conotton gravelly loam, 3 to 8 percent slopes.
Fleetwood sandy loam, 3 to 8 percent slopes, moderately eroded.
Hazleton loam, 3 to 8 percent slopes.
Hazleton loam, 3 to 8 percent slopes, moderately eroded.
Meckesville channery loam, 3 to 8 percent slopes, moderately eroded.
Tunkhannock gravelly loam, 3 to 8 percent slopes.

Potatoes, corn, small grains, hay and pasture, and most other common crops can be grown on these soils. The cropping system should include 1 or 2 years of hay. A cover crop needs to be grown after corn or other clean-tilled crop has been harvested.

Lime and fertilizer should be applied according to the results of soil tests and the crop to be grown. The plowing down of lime and fertilizer encourages roots to penetrate more deeply in the subsoil.

Crops need to be grown in contour strips in most fields, as the soils are subject to moderate erosion. Critical areas and fields on long slopes ought to be protected through the use of diversion terraces.

CAPABILITY UNIT IIe-2

This unit consists of deep, friable, gently sloping soils that have formed in thoroughly mixed parent material that is mostly gray. The soils are well drained but have a pan at a depth of 24 to 36 inches. The pan restricts the movement of water through the profile. As a result, in wet seasons runoff and erosion are increased if the soils are left bare. Above the pan, the soils are permeable. The capacity to hold moisture for plant growth is moderately high. The soils are moderately erodible. They are strongly acid but respond well to lime and fertilizer. The numerous cobbly and channery fragments interfere with tillage. The soils in this unit are:

Laidig gravelly loam, 3 to 8 percent slopes, moderately eroded.
Swartswood channery silt loam, 0 to 8 percent slopes.

These soils are suited to small grains, corn, potatoes, hay and pasture, and to most other crops commonly grown. Runoff can be controlled through the use of diversion terraces, stripcropping, grassed waterways, and winter cover crops. To minimize erosion, soils need to be covered as much of the time as possible with growing vegetation or with stubble. Lime and fertilizer should be applied according to the needs indicated by soil tests.

CAPABILITY UNIT IIe-3

These soils are gently sloping, moderately deep, well drained, and friable. They have numerous fragments of siltstone and shale in the profile. The coarse fragments interfere somewhat with tillage and planting, but otherwise the soils can be worked easily. Water and roots can penetrate readily. The moisture-holding capacity is moderate. The soils in this unit are:

Hartleton channery silt loam, 3 to 8 percent slopes, moderately eroded.
Leck Kill channery silt loam, 3 to 8 percent slopes, moderately eroded.

These soils are suited to all the crops commonly grown in the county, but in dry seasons yields are lower. Organic matter and living vegetation are needed to protect the soils and keep them porous. The cropping system should include cover crops grown in winter and at least 2 years of hay. The hay and cover crop will provide organic matter and improve soil tilth. Contour stripcropping is needed in most areas. Areas in which runoff concentrates need to be protected by diversion terraces. Lime and fertilizer ought to be applied according to the results of soil tests.

CAPABILITY UNIT IIe-4

The soils in this unit are deep to moderately deep and are moderately well drained. They are gently sloping and were formed in red and gray glacial till or colluvium. The soils are moderately to slowly permeable and have a moderate to high capacity to hold moisture that plants can use. They are acid. The penetration of water and roots is limited by a pan that is at a depth of about 20 to

24 inches. This makes the soils slightly wet. The soils in this unit are:

Albrights channery loam, 3 to 8 percent slopes, moderately eroded.
Albrights silt loam, 3 to 8 percent slopes, moderately eroded.
Buchanan gravelly loam, 3 to 10 percent slopes, moderately eroded.
Comly silt loam, 3 to 8 percent slopes, moderately eroded.
Drifton loam, 3 to 8 percent slopes, moderately eroded.
Watson gravelly silt loam, 0 to 8 percent slopes, moderately eroded.
Watson silt loam, 3 to 8 percent slopes, moderately eroded.
Wurtsboro channery loam, 3 to 8 percent slopes, moderately eroded.

These soils are well suited to all of the crops grown locally, except alfalfa and potatoes. Diversion terraces, graded stripcropping, winter cover crops, and grassed waterways are needed to control erosion and to dispose of excess water safely. Random closed drains are needed in some places to drain wet spots or seeps.

Apply lime and fertilizer according to the needs indicated by soil tests. Because the Comly soil is somewhat poorly drained in places, it requires closer spacing of diversion ditches and surface drains than other soils in the group.

CAPABILITY UNIT IIw-1

The soils in this unit have formed in medium- to fine-textured alluvial material. They are level to gently sloping and are deep, friable, and moderately well drained. The nearly level soil is flooded occasionally and has a high water table part of the time. The gently sloping soil is kept wet part of the time by seepage from higher areas and by a firm layer in the lower part of the subsoil. The firm layer also hinders the penetration of water and roots. Productivity of these soils is moderate, and the capacity to hold moisture for plant growth is moderate to high. Erosion is somewhat of a hazard because of runoff from higher lying areas. The soils in this unit are:

Middlebury silt loam, 0 to 3 percent slopes.
Middlebury silt loam, 3 to 8 percent slopes.

These soils are suited to pasture and to most of the crops commonly grown in the county. Ladino clover grows well, but the soils are not suited to deep-rooted legumes and trees. The areas along the major streams are better suited to cultivation than the areas along small streams. The areas along the small streams are narrow, which limits the use of farm machinery. These narrow areas are better suited to pasture.

Grazing when the soil is wet should be avoided because it compacts the soil and damages the pasture plants. Excess water can be disposed of through use of random closed drains, open ditches, or grassed waterways. The removal of excess water helps the soil warm up earlier in spring.

CAPABILITY UNIT IIw-2

The soils in this unit have formed in red and gray glacial till, terrace deposits, and frost-worked residuum. They are nearly level, deep to moderately deep, and moderately well drained to somewhat poorly drained. These soils are strongly acid and are medium textured. In most places they are friable. Permeability is moderate to slow, and the capacity for holding moisture for plant growth is moderate to high. A pan at a depth of 20 to 24 inches limits the percolation of water and the development of roots. Erosion is a hazard if the soil is left bare. The soils in this unit are:

Albrights channery loam, 0 to 3 percent slopes.
Albrights silt loam, 0 to 3 percent slopes.
Comly silt loam, 0 to 3 percent slopes.
Drifton loam, 0 to 3 percent slopes.
Pekin silt loam, 0 to 3 percent slopes.
Watson silt loam, 0 to 3 percent slopes.
Wurtsboro channery loam, 0 to 3 percent slopes.

Spring plowing and planting may be delayed on these soils, and winter wheat may be damaged. These soils, however, are well suited to spring grains, hay, and pasture. They are also well suited to corn, but may be damaged by early frosts. Drainage improves these soils for potatoes. Lime and fertilizer should be applied according to the results of soil tests and the kind of crop to be grown.

The use of diversion terraces, cover crops, and graded stripcropping helps reduce the effects of excess water. The Pekin and Comly soils are less well drained than the other soils. They need to have diversion terraces and tile drains spaced closer than the other soils. Unless natural drainage is improved in these two soils, tillage is delayed in wet seasons.

CAPABILITY UNIT IIs-1

The soils in this unit have developed on uplands from siltstone and shale and a mixture of glacial till and frost-worked residuum, or on gravelly outwash terraces. They are nearly level, moderately deep to deep, and medium textured. These soils have numerous coarse fragments or gravel scattered throughout the profile, and these may interfere with the seeding of small grains and other crops. Permeability is moderately rapid, and the capacity to supply moisture for growing plants is moderate. The soils in this unit are:

Conotton gravelly loam, 0 to 3 percent slopes.
Hartleton channery silt loam, 0 to 3 percent slopes.
Leck Kill channery silt loam, 0 to 3 percent slopes.

These soils are suited to most of the crops grown locally. The shallowness of the profile limits the supply of moisture and the depth of the rooting zone for alfalfa, fruit trees, and other deep-rooted plants. Plants are damaged by drought in some seasons. Because the soils are well aerated, organic matter is consumed quickly. It should be maintained by rotating crops and growing cover crops. Lime and fertilizer ought to be applied according to the results of soil tests. Contour tillage needs to be practiced where possible.

CAPABILITY UNIT IIIe-1

The soils in this unit have developed in red or gray glacial drift. They are deep and friable and are easily worked. They are well drained and are permeable to roots and water. The soils have moderate to high capacity to supply moisture for growing plants. Except where heavily limed, they are moderately to strongly acid. The soils in this unit are:

Allenwood gravelly loam and silt loam, 8 to 15 percent slopes, moderately eroded.
Allenwood gravelly silt loam, 8 to 15 percent slopes, moderately eroded.
Fleetwood sandy loam, 8 to 15 percent slopes, moderately eroded.
Hazleton loam, 8 to 15 percent slopes, moderately eroded.
Meckesville channery loam, 8 to 15 percent slopes, moderately eroded.
Tunkhannock gravelly loam, 8 to 15 percent slopes.

These soils are suited to trees and to all of the crops commonly grown in the county, including hay and pasture. The cropping system needs to include a winter cover crop and a high proportion of hay to improve the soil structure, build up the supply of organic matter, and protect the soil from erosion. Lime and fertilizer should be applied according to the results of soil tests and the crop to be grown.

Erosion is a serious hazard, but it can be controlled by use of a combination of practices to conserve the soils. Most fields ought to be planted in contour strips. Where runoff collects, diversion terraces and grassed waterways need to be constructed.

CAPABILITY UNIT IIIe-2

The soils in this unit have moderate to strong slopes and have formed in deep, compact glacial till or colluvium. They are acid and well drained and have a pan at a depth of 24 to 36 inches. Coarse fragments make up 20 to 30 percent of the surface layer. Permeability is rapid through the upper part of the solum, but it is considerably slower in the pan. The available moisture-holding capacity is moderate to high, depending on the percentage of coarse fragments in the profile and the depth to the pan. The amount of runoff is increased and the development of roots is restricted because of the pan. Soils in this unit are:

Laidig gravelly loam, 8 to 15 percent slopes, moderately eroded.
Swartswood channery silt loam, 8 to 15 percent slopes, moderately eroded.

These soils are suited to corn, potatoes, small grains, hay, and most other crops grown in the county. Cobbly and channery fragments, however, interfere somewhat with the planting of corn and the drilling of small grains.

Fields on long slopes need to be planted in contour strips and given the additional protection of diversion terraces, grassed waterways, and a winter cover crop. Living vegetation ought to cover the soils at all times to protect them from erosion.

Lime and fertilizer should be applied according to the results of soil tests and the kind of crop to be grown.

CAPABILITY UNIT IIIe-3

These soils are acid, moderately deep to deep, and well drained. They have numerous fragments of siltstone and shale in the profile, and these interfere somewhat with tillage. The available moisture-holding capacity for growing plants is moderate; permeability is moderately rapid. Roots can penetrate the subsoil easily. The soils in this unit are:

Hartleton channery silt loam, 8 to 15 percent slopes, moderately eroded.
Leck Kill channery silt loam, 8 to 15 percent slopes, moderately eroded.

These soils are suited to most of the crops grown in the area. Because of the slight droughtiness and moderate slopes, they are better suited to hay or pasture than to cultivated crops. Fields that are cultivated should be planted in contour strips. In winter the soils need to be protected by a cover crop. Hay should be grown in the cropping system a large part of the time. The hay and cover crops help to maintain the supply of organic matter and to keep the soils porous. Fields on long slopes need the additional protection of diversion terraces that will control runoff and carry off excess water. Lime and fertilizer ought to be applied according to the needs indicated by soil tests.

CAPABILITY UNIT IIIe-4

The soils in this unit are nearly level to gently sloping and have developed on red and gray, thin-bedded shale and siltstone. They are shallow—only 15 to 18 inches thick—and are well drained and strongly acid. The soils are permeable to water and roots and are low in moisture-holding capacity. Coarse fragments interfere with planting; droughtiness retards germination and the growth of plants. The soils in this unit are:

Klinesville channery silt loam, 3 to 8 percent slopes, moderately eroded.
Montevallo channery silt loam, 0 to 3 percent slopes.
Montevallo channery silt loam, 3 to 8 percent slopes, moderately eroded.
Rushtown shaly silt loam, 3 to 8 percent slopes.

These soils can be used for most crops, but they are more suitable for hay and pasture than for cultivated crops. The yields of corn and other row crops are uncertain because of the low moisture-holding capacity of the soils and the possible shortage of rain. Small grains generally yield fairly well.

Fields should be planted in contour strips, and the soils need to be protected by living vegetation grown for green manure or winter cover. In addition to providing protection, the cover crop will replenish organic matter, which is rapidly oxidized in these soils. Lime and fertilizer should be applied according to the needs indicated by soil tests.

CAPABILITY UNIT IIIe-5

The soils in this unit are friable, deep to moderately deep, and moderately well drained. They are strongly acid if they have not been limed. They are highly erodible. The soils are slightly sticky when wet. A pan at a depth of 18 to 24 inches restricts the penetration of water and roots. Permeability is moderate to slow. The soils have moderate capacity to hold moisture, and are moderate in productivity. The soils in this unit are:

Comly silt loam, 8 to 15 percent slopes.
Watson silt loam, 8 to 15 percent slopes, moderately eroded.

These soils are fairly well suited to corn, oats, hay, and pasture, but they are only moderately well suited to wheat and potatoes. Erosion can be controlled and drainage improved by planting fields in graded strips and by constructing diversions and random closed drains. Growing hay for 2 or 3 years in the cropping system and protecting the soils with a winter cover crop will reduce the hazard of erosion and help to improve soil tilth. Lime and fertilizer should be applied according to the needs indicated by soil tests.

CAPABILITY UNIT IIIw-1

The soils in this unit have formed in glacial till. They are acid, are somewhat poorly drained to poorly drained, and have a tight, slowly permeable pan in the subsoil at a depth of 16 to 20 inches. The subsurface layer and the subsoil are prominently mottled. Runoff received from higher areas and the dense pan cause the soils to be wet. The surface layer is friable when moist, but it is sticky when wet. The soils can hold a moderate supply of

available moisture for growing plants. The soils in this unit are:

Alvira gravelly silt loam, 0 to 8 percent slopes.
Alvira and Shelmadine silt loams, 0 to 3 percent slopes.
Alvira and Shelmadine silt loams, 3 to 8 percent slopes, moderately eroded.
Volusia silt loam, 0 to 8 percent slopes.

These soils are well suited to buckwheat, hay, and pasture. They are only moderately well suited to other field crops but can be made more suitable by improving the natural drainage. Protection from erosion and improvement in drainage are needed. They can be obtained through the use of field and diversion terraces on slopes and by bedding the soil and constructing open ditches and random closed drains in level or nearly level areas.

Pastures and meadows can be drained adequately by placing closed drains and diversion terraces in seepy areas and wet spots. Lime and fertilizer should be applied according to the needs indicated by soil tests and according to the crop to be grown.

CAPABILITY UNIT IVe-1

The soils in this unit have developed in deep glacial drift. They are acid, friable, well drained, and medium textured. These soils are permeable to roots and water and have a moderate to moderately high capacity to supply available moisture for growing plants. Runoff and erosion are severe hazards on unprotected soils. The severely eroded soil is shallower than the moderately eroded or slightly eroded ones. The soils in this unit are:

Allenwood gravelly silt loam, 15 to 25 percent slopes, moderately eroded.
Allenwood gravelly silty clay loam, 8 to 15 percent slopes, severely eroded.
Conotton gravelly loam, 15 to 25 percent slopes.
Tunkhannock gravelly loam, 15 to 25 percent slopes.

These soils are subject to severe erosion if they are cultivated regularly. If well managed, however, they can be tilled occasionally. The soils are well suited to hay and pasture. If they are seeded to hay, they need to be protected by diversion terraces. Long slopes should be seeded in strips. Lime and fertilizer, applied according to the results of soil tests, are necessary for highest yields.

CAPABILITY UNIT IVe-2

The soils of this unit are moderately deep and have developed from glaciated or frost-worked residuum. The severely eroded soils are shallower than the moderately eroded ones. The combination of strong slopes and erosion, plus the moderately low moisture-holding capacity, places severe limitations on their use. The soils in this unit are:

Hartleton channery silt loam, 8 to 15 percent slopes, severely eroded.
Hartleton channery silt loam, 15 to 25 percent slopes, moderately eroded.
Leck Kill channery silt loam, 8 to 15 percent slopes, severely eroded.
Leck Kill channery silt loam, 15 to 25 percent slopes, moderately eroded.

These soils should be used only occasionally for grain or for tilled crops. However, they are moderately well suited to hay or pasture. Land intended for pasture ought to be seeded in strips; long slopes need to be protected by diversion terraces. Alfalfa or birdsfoot trefoil and other permanent forage plants should be sown. Lime and fertilizer ought to be applied according to the needs indicated by soil tests.

CAPABILITY UNIT IVe-3

The soils in this unit are shallow—only 6 to 18 inches thick over loose, red or gray siltstone and shale. The severely eroded soil is shallower than the moderately eroded ones. The soils are well drained but are acid, droughty, and very permeable to water and roots. The capacity to supply moisture for growing plants is low. Numerous coarse fragments interfere somewhat with planting and tillage. The soils in this unit are:

Klinesville channery silt loam, 8 to 15 percent slopes, moderately eroded.
Montevallo channery silt loam, 3 to 8 percent slopes, severely eroded.
Montevallo channery silt loam, 8 to 15 percent slopes, moderately eroded.
Rushtown shaly silt loam, 8 to 15 percent slopes.

The Rushtown soil is droughtier and less erodible than the other soils in this unit. Contour stripcropping, green-manure and cover crops, and a high proportion of hay in the cropping system are needed to protect cultivated areas. Corn and small grains can be grown, but the soils are better suited to hay and pasture because close-growing plants protect them from erosion and reduce runoff.

Birdsfoot trefoil and other drought-resistant forage plants should be seeded for pasture. Lime and fertilizer, in amounts indicated by soil tests, ought to be applied for highest yields of crops.

CAPABILITY UNIT IVe-4

The soils in this unit are acid and are severely eroded. They are moderately well drained and have a slowly permeable layer in the profile. The surface soil puddles and forms a crust when it is exposed to beating raindrops. This causes a breakdown in structure and loss in permeability. Porosity and the capacity to hold moisture are also reduced. In addition, the Middlebury and Tioga silt loams are subject to severe erosion through the overflow of streams. These characteristics and inadequate cropping practices have caused the soils to be severely eroded. The soils in this unit are:

Comly silty clay loam, 8 to 15 percent slopes, severely eroded.
Middlebury and Tioga silt loams, 0 to 3 percent slopes, severely eroded.
Watson silty clay loam, 8 to 15 percent slopes, severely eroded.

These soils should be used only occasionally for tilled crops. They are better suited to hay or pasture. Legumes, grasses, and other permanent vegetation protect them from erosion, reduce runoff, and maintain their structure and permeability. If cultivated, the sloping soils should be protected by diversion terraces and by crops grown in parallel strips on the contour. Lime and fertilizer should be applied according to the needs indicated by soil tests.

CAPABILITY UNIT IVw-1

The soils in this unit have formed in mixed parent material derived from glacial till, colluvium, and local rocks. They are nearly level to gently sloping. These soils are strongly acid, poorly drained, and have a tight, slowly permeable subsoil. The subsurface layer and the subsoil are prominently mottled. Runoff received from higher areas adds to the wetness of these soils. Permeability and internal drainage are slow, and the available moisture-

holding capacity is moderate. Moisture is at field capacity about half the year. Soils in this unit are:

Shelmadine silt loam, 0 to 3 percent slopes.
Shelmadine silt loam, 3 to 8 percent slopes, moderately eroded.

These soils are fairly well suited to buckwheat, hay, and pasture. If farmed for other crops, they have very severe limitations and require careful management. Drainage, rather than erosion, is the primary problem on these soils. Bedding or shallow ditching is needed to remove excess water and allow timely field operations. If drainage is provided, some of the moisture-tolerant, shallow-rooted crops can be grown. However, these soils are better suited to permanent hay or pasture.

CAPABILITY UNIT Vw-1

The soils in this unit are in depressions or swamps and on gentle slopes around permanently flowing springs. They are medium textured and are very poorly drained. The soils have a tight layer in the subsoil and are waterlogged most of the year. In some of them there is a perched water table. The soils in this unit are:

Lickdale and Tughill loams and silt loams, 0 to 3 percent slopes.
Norwich silt loam, 0 to 3 percent slopes.
Norwich silt loam, 3 to 8 percent slopes.

These soils have some use as pasture, but they are hard to manage in their present state of wetness. In places, surface or subsurface drainage is practical. Reed canarygrass (*Phalaris arundinacea*) is suited to these soils. It makes a lush growth on similar sites. Grazing or using machinery when the soils are wet causes compaction and should be avoided. Lime and fertilizer ought to be applied according to the needs indicated by soil tests.

CAPABILITY UNIT VIe-1

The soils in this unit are deep and well drained but are severely eroded. They are moderately steep and have lost all of their surface layer and part of their subsoil through erosion. Consequently, they are now shallower than uneroded soils on similar slopes. In addition, they are more compact and less permeable to water and air. The available moisture-holding capacity is moderate. Runoff is high if these soils are not protected. The soils in this unit are:

Allenwood gravelly silty clay loam, 15 to 25 percent slopes, severely eroded.
Laidig gravelly loam, 15 to 25 percent slopes, severely eroded.

Runoff and erosion are more of a hazard on the Laidig soil than on the Allenwood soil because of the compact layer.

The soils should be planted to permanent pasture or to trees. Alfalfa or birdsfoot trefoil and other long-lived legumes are suitable for seeding. Lime and fertilizer should be applied according to soil tests and the kind of crop to be grown. Annual applications of fertilizer are necessary to keep the pastures vigorous and productive. In some places it is necessary to install diversion terraces to protect new seedings.

CAPABILITY UNIT VIe-2

The soils in this unit are on red and gray shale ridges. They are moderately sloping to moderately steep, and they are shallow to moderately deep, rapidly permeable, and acid. In addition, they have a low moisture-holding capacity. Erosion is a serious hazard if the soils are not protected. The soils in this unit are:

Hartleton channery silt loam, 15 to 25 percent slopes, severely eroded.
Klinesville channery silt loam, 8 to 15 percent slopes, severely eroded.
Klinesville channery silt loam, 15 to 25 percent slopes, moderately eroded.
Leck Kill channery silt loam, 15 to 25 percent slopes, severely eroded.
Montevallo channery silt loam, 8 to 15 percent slopes, severely eroded.
Montevallo channery silt loam, 15 to 25 percent slopes, moderately eroded.
Rushtown shaly silt loam, 15 to 25 percent slopes.

These soils can be used for hay and pasture. If seeded to birdsfoot trefoil and other drought-resistant legumes, they will produce enough forage to justify the time and money spent in establishing the forage plants. If lime and fertilizer are applied according to the needs indicated by soil tests, these soils will produce as much forage in wet years as the deeper soils.

CAPABILITY UNIT VIw-1

The soils in this unit have developed on flood plains in alluvial or locally ponded sediments, and they are subject to frequent overflow. They are poorly to very poorly drained. In most places the water table is high most of the time. The moisture-holding capacity is moderate, and the soils are moderate in productivity. The soils in this unit are:

Holly silt loam.
Papakating silty clay loam.

In their natural condition, these soils are limited to seasonal pasture. Reed canarygrass (*Phalaris arundinacea*) and other grasses that tolerate wetness can be grown. Adding lime and fertilizer will markedly improve the yields of forage. Bedding the soil and constructing open drainage ditches will lengthen the period in which the soils can be grazed. If these soils are drained adequately, shallow-rooted crops can be grown.

CAPABILITY UNIT VIs-1

The soils in this unit are acid and are nearly level to moderately steep. They are deep and well drained but are very stony. The soils cannot be cultivated, because they have too many or too large stones and boulders on the surface. They are permeable to water and roots and have a moderate to high available moisture-holding capacity. The soils in this unit are:

Fleetwood very stony sandy loam, 0 to 8 percent slopes.
Fleetwood very stony sandy loam, 8 to 25 percent slopes.
Hartleton very stony loam, 0 to 8 percent slopes.
Hartleton very stony loam, 8 to 25 percent slopes.
Hazleton very stony loam, 0 to 8 percent slopes.
Hazleton very stony loam, 8 to 25 percent slopes.
Laidig very stony loam, 3 to 8 percent slopes.
Laidig very stony loam, 8 to 25 percent slopes.
Meckesville very stony loam, 0 to 8 percent slopes.
Meckesville very stony loam, 8 to 25 percent slopes.
Swartswood very stony loam, 0 to 8 percent slopes.
Swartswood very stony loam, 8 to 25 percent slopes.

These soils are suited to improved pasture and trees. The surface stoniness is a limitation in reseeding for pasture and in the regeneration of woodland.

Nearly all of these soil areas are wooded. Many areas were once forested with sugar maple, white and red oaks, white pine, and hemlock. Destructive logging and re-

curring fires have reduced the cover, and it is now mainly scrub oak, huckleberry, sheep laurel, and gray birch.

CAPABILITY UNIT VIs-2

The soils in this unit are acid and are nearly level to moderately steep. They are well drained and are shallow to moderately deep. These soils have a moderate to low moisture-holding capacity and a shallow to moderately deep root zone. They are too stony for cultivation. The soils in this unit are:

Dekalb very stony loam, 0 to 8 percent slopes.
Dekalb very stony loam, 8 to 25 percent slopes.
Fleetwood very stony loam, shallow, 0 to 8 percent slopes.
Fleetwood very stony loam, shallow, 8 to 25 percent slopes.
Klinesville very stony silt loam, 8 to 25 percent slopes.
Leck Kill very stony loam, 0 to 8 percent slopes.
Leck Kill very stony loam, 8 to 25 percent slopes.
Lordstown very stony silt loam, 0 to 8 percent slopes.
Lordstown very stony silt loam, 8 to 25 percent slopes.

These soils are suited to pasture and trees. Most of them are now wooded, but fires and windthrow are common. Natural regeneration of woodlands is difficult because of the fires and because the soils are droughty and stony. Trees grow best on the north- and east-facing slopes where the supply of moisture is more favorable than on south- and west-facing slopes. Stones on the surface interfere to a moderate extent with logging.

CAPABILITY UNIT VIs-3

The soils in this unit are acid and very stony. They are nearly level to moderately steep. Most of them are deep and moderately well drained. Those of the Comly series, however, are moderately deep to deep and are moderately well drained to somewhat poorly drained. The Natalie and Buchanan soils are moderately well drained to somewhat poorly drained.

All the soils in this unit have stones and boulders concentrated on the surface and some scattered throughout the profile. They have a moderate problem of excess moisture because of the weak to strong fragipan that is commonly at a depth of 20 to 26 inches. Permeability is moderate to slow. The capacity for holding available moisture is moderate to moderately high. The soils in this unit are:

Albrights very stony loam, 0 to 8 percent slopes.
Albrights very stony loam, 8 to 25 percent slopes.
Buchanan very stony loam, 0 to 8 percent slopes.
Buchanan very stony loam, 8 to 25 percent slopes.
Comly very stony silt loam, 0 to 8 percent slopes.
Comly very stony silt loam, 8 to 25 percent slopes.
Drifton very stony loam, 0 to 8 percent slopes.
Natalie very stony loam, 0 to 8 percent slopes.
Wurtsboro very stony loam, 0 to 8 percent slopes.
Wurtsboro very stony loam, 8 to 25 percent slopes.

These soils are too stony for cultivation but are suited to pasture or trees. Nearly all the soils are wooded. The trees are mainly scrub oak and other poor species, but some areas are in pine, hemlock, red maple, and mixed oaks. Areas in pasture can be improved if necessary.

The woodlands need protection from fire and improvement in cutting and logging practices. Stoniness interferes with logging and with natural reseeding to some extent. Woodland borders should be established to help overcome the hazard of windthrow on these soils.

CAPABILITY UNIT VIs-4

The soils in this unit are level to gently sloping and are acid, very stony, and somewhat poorly drained to poorly drained. Drainage is restricted by a strong fragipan that is commonly at a depth of 12 to 18 inches. Runoff from higher areas adds moisture to these already poorly drained soils.

The Shelmadine soils have developed from glacial till. There is a moderate difference in the texture of the A and B horizons. The Volusia and Alvira soils have developed from gray till. The texture of the A and the B horizons differ but little.

All of these soils are slowly permeable; runoff is slow to moderate. The root zone is shallow to moderately deep, and the capacity to supply available moisture for growing plants is moderate to moderately low. The soils in this unit are:

Alvira very stony silt loam, 0 to 8 percent slopes.
Alvira and Shelmadine very stony silt loams, 0 to 8 percent slopes.
Volusia very stony loam, 0 to 8 percent slopes.

These soils are suited to improved pasture and trees. Nearly all the areas are now wooded. They need woodland protection from fire and improvement in management. The growth of the trees is slow. Dense stands of timber ought to be thinned and, if mature, the trees need to be harvested selectively. Fire lanes should be cleared in the woodlands. Woodland borders need to be established to help overcome the serious hazard of windthrow on these wet soils. Wetness and stoniness interfere with natural reseeding of the trees and with travel and logging.

CAPABILITY UNIT VIIe-1

The soils in this unit are acid, droughty, and shallow and are steep to very steep. Unless protected, they are all subject to severe erosion. Most of them have lost all or nearly all of the original surface layer through erosion. Productivity is low. The soils in this unit are:

Klinesville channery silt loam, 15 to 25 percent slopes, severely eroded.
Klinesville channery silt loam, 25 to 35 percent slopes, moderately eroded.
Klinesville channery silt loam, 25 to 35 percent slopes, severely eroded.
Klinesville channery silt loam, 35 to 80 percent slopes.
Klinesville channery silt loam, 35 to 80 percent slopes, severely eroded.
Montevallo channery silt loam, 15 to 25 percent slopes, severely eroded.
Montevallo channery silt loam, 25 to 35 percent slopes, moderately eroded.
Montevallo channery silt loam, 25 to 35 percent slopes, severely eroded.
Montevallo channery silt loam, 35 to 100 percent slopes, eroded.
Rushtown shaly silt loam, 25 to 35 percent slopes.

These soils are best suited to pasture or trees. The growth of the trees is very slow, except on moist north- and east-facing slopes and along streams. The trees are useful as watershed protection and as a limited source of Christmas trees.

CAPABILITY UNIT VIIw-1

This unit consists of organic soils that range from 1½ to 30 feet or more in thickness. In most places the soils are 5 to 20 feet thick. The soils in this unit are:

Muck and Peat.

These soils have a permanent high water table and are acid. Most areas are small, and none are used as commercial sources of organic material. Their greatest value is that they function as natural reservoirs for water. Some areas are wooded and have black spruce and red maple growing on them.

CAPABILITY UNIT VIIs-1

The soils in this unit are deep and poorly drained or very poorly drained and are wet most of the time. Seepage, runoff, springs, and an impervious layer at a moderate depth prevent proper drainage. The soils are level to very gently sloping. Numerous stones and boulders are on the surface. Permeability is very slow, and the available moisture-holding capacity is low. The soils in this unit are:

Andover very stony loam, 0 to 3 percent slopes.
Morris very stony silt loam, 0 to 8 percent slopes.
Shelmadine very stony silt loam, 0 to 8 percent slopes.
Tioga and Middlebury very stony loams, 0 to 8 percent slopes.

These soils are too stony and wet for cultivation or improved pasture, and they have only limited use for trees. Because of poor drainage, the root zone is shallow for trees. Windthrow is a hazard. Fire is less a hazard than on the better drained soils, except in the dry season of the year. Travel and logging in the woodlands are difficult.

CAPABILITY UNIT VIIs-2

The soils in this unit are in swamps and depressions and have developed in deep glacial till. They are very poorly drained and have numerous stones and boulders on the surface. The surface soils are thick, black, and high in organic matter; the subsoils are grayish. The soils in this unit are:

Lickdale and Tughill very stony loams, 0 to 8 percent slopes.
Norwich very stony loam, 0 to 8 percent slopes.

These soils are too wet and stony for cultivation or improved pasture, and they are poorly suited to trees. However, spruce, red maple, some larch, and rhododendron are on most of the areas but are growing slowly. Sphagnum moss is small but is a good ground cover. These soils are mainly useful as watersheds for streams in the area.

CAPABILITY UNIT VIIs-3

The soils in this unit are acid, shallow, and very stony. Outcrops of bedrock are common on all the soils, except the Klinesville. All the soils have a low moisture-holding capacity and a shallow root zone. The soils are steep to very steep.

The soils in this unit are:

Dekalb very stony loam, 25 to 100 percent slopes.
Fleetwood very stony loam, shallow, 25 to 100 percent slopes.
Klinesville very stony silt loam, 25 to 80 percent slopes.
Leck Kill very stony loam, 25 to 100 percent slopes.
Lordstown very stony silt loam, 25 to 80 percent slopes.

Nearly all the acreage of these soils is in trees. The growth of trees is slow because of the shallow root zone and low moisture-holding capacity. The trees grow better on the north- and east-facing slopes than on south- and west-facing ones. Logging trails are a severe erosion hazard on these soils, unless properly constructed and maintained. The soils in this unit produce some wood products, but their main value is for recreation, watershed protection, and wildife. Lanes should be cleared in the woodlands as a fire-prevention measure.

CAPABILITY UNIT VIIIs-1

This unit consists of all the miscellaneous land types in the county, which do not have soil cover. The areas are stony, steep, or unproductive and have no continuous mantle of soil. The land types in this unit are:

Made land.
Mine dumps.
Mine dumps, coal.
Riverwash.
Riverwash, coal.
Strip mines.
Very stony land, 0 to 8 percent slopes.
Very stony land, 8 to 25 percent slopes.
Very stony land, 25 to 120 percent slopes.

These land types are too stony, acid, and infertile or unstable for any use except for wildlife and scenery. Some areas of Made land and Strip mines can be planted in trees that are suited to the site. Vegetation on these land types is valuable for watershed protection.

Productivity ratings of the soils

Productivity ratings for the soils in Carbon County are given in table 1. The productivity rating for each crop grown on a soil is the percentage of the standard yield given at the top of the column. The standard yield is the average yield of that particular crop obtained on the best soils in the county under ordinary management.

The figures in columns A show the percentage of the standard yield that can be expected under the level of management commonly used in the county; those in columns B show the percentage of the standard yield that could be obtained by applying the best practices now available to increase production. These practices consist of liming the soils and applying fertilizer according to the needs indicated by soil tests; of applying all practices needed to control erosion and to conserve moisture, organic matter, and tilth; and of improving drainage where necessary. They also include choosing improved varieties of crops and forage plants and seeding at the proper rates and times.

The estimates are based on interviews with farmers during the soil survey and on the knowledge of soil properties that affect crop yields. They are also based on the behavior of similar soils in other areas and on average yield data in Carbon County.

TABLE 1.—*Estimated relative productivity ratings of soils for crops, meadow, and pasture*

[Productivity indexes in columns A are for common management; those in columns B are for improved management. Absence of data indicates crop specified is not commonly grown or soil is not suited to it. Stony soils are not in table because they do not contribute substantially to the acreage in cultivation, meadow, or pasture]

Soils	Corn (100=50 bu. per acre)		Wheat (100=28 bu. per acre)		Oats (100=40 bu. per acre)		Alfalfa hay (100=1.7 tons per acre)		Mixed hay (100=1.4 tons per acre)		Barley (100=30 bu. per acre)		Potatoes (100=200 bu. per acre)		Pasture [1] (100=80 cow-acre-days)	
	A	*B*	*A*	*B*	*A*	*B*	*A*	*B*	*A*	*B*	*A*	*B*	*A*	*B*	*A*	*B*
Albrights channery loam, 0 to 3 percent slopes	60	150	-----	-----	65	155	-----	-----	80	165	-----	-----	75	200	85	180
Albrights channery loam, 3 to 8 percent slopes, moderately eroded	60	150	-----	-----	70	155	-----	-----	85	185	-----	-----	80	215	90	190
Albrights silt loam, 0 to 3 percent slopes	65	160	-----	-----	65	155	-----	-----	80	165	-----	-----	75	200	85	180
Albrights silt loam, 3 to 8 percent slopes, moderately eroded	65	160	-----	-----	70	155	-----	-----	85	185	-----	-----	80	215	90	190
Allenwood gravelly loam and silt loam, 0 to 3 percent slopes	100	200	100	140	100	175	100	200	100	190	100	185	95	215	100	190
Allenwood gravelly loam and silt loam, 3 to 8 percent slopes, moderately eroded	95	200	95	140	95	175	95	200	95	190	95	185	90	215	95	190
Allenwood gravelly loam and silt loam, 8 to 15 percent slopes, moderately eroded	85	190	90	135	90	165	85	190	85	175	90	175	80	200	85	180
Allenwood gravelly silt loam, 0 to 3 percent slopes	95	190	100	140	100	175	90	190	90	175	100	185	100	225	100	190
Allenwood gravelly silt loam, 3 to 8 percent slopes, moderately eroded	90	190	95	140	95	175	85	190	85	175	95	185	95	225	95	190
Allenwood gravelly silt loam, 8 to 15 percent slopes, moderately eroded	85	180	90	135	90	165	80	180	80	165	90	175	85	215	85	180
Allenwood gravelly silt loam, 15 to 25 percent slopes, moderately eroded	70	160	65	105	65	130	80	180	80	165	65	135	-----	-----	70	160
Allenwood gravelly silty clay loam, 8 to 15 percent slopes, severely eroded	75	180	80	125	80	155	80	180	80	165	80	165	75	190	75	170
Allenwood gravelly silty clay loam, 15 to 25 percent slopes, severely eroded	-----	-----	50	-----	50	-----	75	170	75	160	50	-----	-----	-----	50	150
Alvira gravelly silt loam, 0 to 8 percent slopes	35	120	30	70	30	90	-----	-----	65	160	-----	-----	-----	-----	50	130
Alvira and Shelmadine silt loam, 0 to 3 percent slopes	20	80	20	60	20	70	-----	-----	60	150	-----	-----	-----	-----	30	105
Alvira and Shelmadine silt loam, 3 to 8 percent slopes, moderately eroded	35	120	30	75	30	95	-----	-----	70	165	-----	-----	-----	-----	40	150
Buchanan gravelly loam, 3 to 10 percent slopes, moderately eroded	60	160	60	110	60	140	50	160	80	175	50	135	60	180	80	175
Comly silt loam, 0 to 3 percent slopes	45	130	35	75	35	96	40	120	75	165	25	80	-----	-----	70	170
Comly silt loam, 3 to 8 percent slopes, moderately eroded	60	150	50	100	40	105	60	140	85	185	45	120	-----	-----	85	190
Comly silt loam, 8 to 15 percent slopes	50	140	40	85	40	105	50	120	75	165	40	110	-----	-----	70	170
Comly silty clay loam, 8 to 15 percent slopes, severely eroded	35	120	30	70	30	80	25	90	55	140	25	80	-----	-----	50	130
Conotton gravelly loam, 0 to 3 percent slopes	75	190	90	135	90	165	90	200	90	175	90	175	90	225	85	180
Conotton gravelly loam, 3 to 8 percent slopes	70	180	85	125	85	155	85	190	85	165	85	165	85	215	85	180
Conotton gravelly loam, 15 to 25 percent slopes	50	120	60	-----	60	-----	65	160	65	140	55	-----	-----	-----	70	150
Drifton loam, 0 to 3 percent slopes	65	160	-----	-----	65	150	-----	-----	80	165	-----	-----	70	190	80	170
Drifton loam, 3 to 8 percent slopes, moderately eroded	65	160	-----	-----	70	155	-----	-----	85	185	-----	-----	75	200	85	180
Fleetwood sandy loam, 0 to 3 percent slopes	70	170	80	125	75	155	85	180	85	175	80	155	80	215	85	180
Fleetwood sandy loam, 3 to 8 percent slopes, moderately eroded	65	160	75	120	70	150	75	180	80	165	75	155	80	215	80	180
Fleetwood sandy loam, 8 to 15 percent slopes, moderately eroded	50	150	65	110	60	140	70	170	75	160	70	145	75	190	70	160
Hartleton channery silt loam, 0 to 3 percent slopes	90	190	95	140	95	175	95	200	95	185	95	185	90	215	90	180
Hartleton channery silt loam, 3 to 8 percent slopes, moderately eroded	90	190	95	140	95	175	95	190	95	185	90	185	85	200	90	180
Hartleton channery silt loam, 8 to 15 percent slopes, moderately eroded	80	180	90	135	90	165	85	190	85	175	85	165	80	190	80	170

See footnote at end of table.

TABLE 1.—*Estimated relative productivity ratings of soils for crops, meadow, and pasture*—Continued

Soils	Corn (100=50 bu. per acre)		Wheat (100=28 bu. per acre)		Oats (100=40 bu. per acre)		Alfalfa hay (100=1.7 tons per acre)		Mixed hay (100=1.4 tons per acre)		Barley (100=30 bu. per acre)		Potatoes (100=200 bu. per acre)		Pasture [1] (100=80 cow-acre-days)	
	A	*B*	*A*	*B*	*A*	*B*	*A*	*B*	*A*	*B*	*A*	*B*	*A*	*B*	*A*	*B*
Hartleton channery silt loam, 8 to 15 percent slopes, severely eroded	70	170	75	120	75	150	75	170	75	160	75	165	70	170	65	160
Hartleton channery silt loam, 15 to 25 percent slopes, moderately eroded	65	150	60	105	70	150	70	170	70	150	70	135	-----	-----	60	150
Hartleton channery silt loam, 15 to 25 percent slopes, severely eroded	50	130	55	-----	50	-----	65	160	65	140	45	-----	-----	-----	45	130
Hazleton loam, 0 to 3 percent slopes	80	180	80	125	100	175	-----	-----	100	185	-----	-----	95	215	100	190
Hazleton loam, 3 to 8 percent slopes	75	170	-----	125	95	175	-----	-----	95	185	-----	-----	90	215	95	190
Hazleton loam, 3 to 8 percent slopes, moderately eroded	70	160	75	125	90	165	-----	-----	90	175	-----	-----	85	215	90	180
Hazleton loam, 8 to 15 percent slopes, moderately eroded	65	150	70	110	80	155	-----	-----	80	165	-----	-----	75	190	80	170
Holly silt loam	-----	-----	-----	-----	-----	-----	---	-----	20	55	-----	-----	-----	-----	25	110
Klinesville channery silt loam, 3 to 8 percent slopes, moderately eroded	70	150	70	105	70	130	60	140	70	150	65	130	65	155	70	140
Klinesville channery silt loam, 8 to 15 percent slopes, moderately eroded	60	140	65	105	65	130	55	130	60	130	50	120	55	145	60	130
Klinesville channery silt loam, 8 to 15 percent slopes, severely eroded	-----	-----	50	90	50	115	45	110	55	120	40	90	35	100	40	95
Klinesville channery silt loam, 15 to 25 percent slopes, moderately eroded	-----	-----	45	85	45	105	45	110	55	120	40	90	-----	-----	40	95
Klinesville channery silt loam, 15 to 25 percent slopes, severely eroded	-----	-----	40	-----	40	-----	35	110	50	110	30	-----	-----	-----	25	75
Klinesville channery silt loam, 25 to 35 percent slopes, moderately eroded	---	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Klinesville channery silt loam, 25 to 35 percent slopes, severely eroded	-----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	-----	----	-----
Klinesville channery silt loam, 35 to 80 percent slopes	-----	-----	-----	-----	-----	-----	-----	---	-----	-----	-----	-----	-----	-----	-----	-----
Klinesville channery silt loam, 35 to 80 percent slopes, severely eroded	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Laidig gravelly loam, 3 to 8 percent slopes, moderately eroded	70	170	75	125	80	165	70	190	80	175	75	155	85	215	80	180
Laidig gravelly loam, 8 to 15 percent slopes, moderately eroded	65	160	70	110	65	150	75	180	80	165	65	150	75	190	75	170
Laidig gravelly loam, 15 to 25 percent slopes, severely eroded	-----	-----	50	-----	55	----	65	160	70	160	45	130	50	-----	55	150
Leck Kill channery silt loam, 0 to 3 percent slopes	80	180	90	125	90	155	85	180	85	165	85	155	90	200	90	180
Leck Kill channery silt loam, 3 to 8 percent slopes, moderately eroded	80	180	90	125	90	155	85	180	85	165	85	155	85	190	90	180
Leck Kill channery silt loam, 8 to 15 percent slopes, moderately eroded	70	160	75	110	75	140	75	170	75	160	75	145	70	180	70	150
Leck Kill channery silt loam, 8 to 15 percent slopes, severely eroded	55	140	65	105	65	130	60	150	65	130	55	120	55	145	55	120
Leck Kill channery silt loam, 15 to 25 percent slopes, moderately eroded	55	140	65	105	65	130	60	150	65	130	55	120	-----	-----	55	120
Leck Kill channery silt loam, 15 to 25 percent slopes, severely eroded	-----	-----	45	-----	45	-----	45	120	55	120	35	-----	-----	-----	30	105
Lickdale and Tughill loams and silt loams, 0 to 3 percent slopes	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	85
Meckesville channery loam, 0 to 3 percent slopes	80	180	80	125	95	165	-----	-----	90	175	80	155	95	215	90	190
Meckesville channery loam, 3 to 8 percent slopes, moderately eroded	75	170	80	125	90	165	-----	-----	85	175	75	155	90	200	85	190
Meckesville channery loam, 8 to 15 percent slopes, moderately eroded	70	160	70	110	80	150	-----	-----	80	165	70	145	80	190	80	170
Middlebury silt loam, 0 to 3 percent slopes	95	190	80	120	85	155	80	170	95	175	85	165	75	180	100	190
Middlebury silt loam, 3 to 8 percent slopes	95	200	85	125	90	155	85	180	95	185	90	175	85	200	100	190
Middlebury and Tioga silt loams, 0 to 3 percent slopes, severely eroded	55	-----	45	-----	50	130	-----	-----	65	160	40	-----	35	-----	70	160
Montevallo channery silt loam, 0 to 3 percent slopes	65	150	70	105	70	130	65	150	70	150	65	130	65	155	70	150
Montevallo channery silt loam, 3 to 8 percent slopes, moderately eroded	60	140	65	105	65	130	55	130	65	140	60	130	60	155	65	140

See footnote at end of table.

TABLE 1.—*Estimated relative productivity ratings of soils for crops, meadow, and pasture*—Continued

Soils	Corn (100=50 bu. per acre)		Wheat (100=28 bu. per acre)		Oats (100=40 bu. per acre)		Alfalfa hay (100=1.7 tons per acre)		Mixed hay (100=1.4 tons per acre)		Barley (100=30 bu. per acre)		Potatoes (100=200 bu. per acre)		Pasture [1] (100=80 cow-acre-days)	
	A	*B*	*A*	*B*	*A*	*B*	*A*	*B*	*A*	*B*	*A*	*B*	*A*	*B*	*A*	*B*
Montevallo channery silt loam, 3 to 8 percent slopes, severely eroded	55	130	60	100	60	120	50	120	55	130	50	120	55	145	60	130
Montevallo channery silt loam, 8 to 15 percent slopes, moderately eroded	50	130	60	100	60	120	50	120	55	130	45	110	50	135	55	120
Montevallo channery silt loam, 8 to 15 percent slopes, severely eroded	-----	-----	45	85	45	105	40	110	50	120	35	90	30	100	35	95
Montevallo channery silt loam, 15 to 25 percent slopes, moderately eroded	-----	-----	40	75	40	95	40	110	50	120	25	-----	-----	-----	20	65
Montevallo channery silt loam, 15 to 25 percent slopes, severely eroded	25	-----	35	-----	35	-----	30	100	45	110	25	-----	-----	-----	20	65
Montevallo channery silt loam, 25 to 35 percent slopes, moderately eroded	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Montevallo channery silt loam, 25 to 35 percent slopes, severely eroded	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Montevallo channery silt loam, 35 to 100 percent slopes, eroded	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Norwich silt loam, 0 to 3 percent slopes	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	85
Norwich silt loam, 3 to 8 percent slopes	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	85
Papakating silty clay loam	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	20	130
Pekin silt loam, 0 to 3 percent slopes	50	160	30	100	60	130	-----	-----	75	165	20	110	-----	155	50	130
Rushtown shaly silt loam, 3 to 8 percent slopes	55	100	55	90	55	105	-----	-----	50	110	50	110	40	110	50	95
Rushtown shaly silt loam, 8 to 15 percent slopes	35	80	45	-----	40	-----	-----	-----	40	90	45	-----	-----	-----	30	55
Rushtown shaly silt loam, 15 to 25 percent slopes	-----	-----	20	-----	15	-----	-----	-----	30	75	-----	-----	-----	-----	20	40
Rushtown shaly silt loam, 25 to 35 percent slopes	-----	-----	-----	-----	-----	-----	-----	-----	20	-----	-----	-----	-----	-----	-----	-----
Shelmadine silt loam, 0 to 3 percent slopes	20	70	20	55	20	70	-----	-----	60	130	-----	-----	-----	-----	25	95
Shelmadine silt loam, 3 to 8 percent slopes, moderately eroded	30	110	25	70	25	90	-----	-----	65	160	-----	-----	-----	-----	35	140
Swartswood channery silt loam, 0 to 8 percent slopes	65	160	70	120	75	155	-----	-----	75	165	-----	-----	80	200	80	170
Swartswood channery silt loam, 8 to 15 percent slopes, moderately eroded	60	150	65	105	60	140	-----	-----	70	160	-----	-----	70	180	75	160
Tioga fine sandy loam	90	180	90	140	100	175	85	175	80	170	90	180	90	200	80	160
Tioga silt loam	100	200	100	140	100	175	100	200	100	185	100	185	100	225	100	190
Tunkhannock gravelly loam, 0 to 3 percent slopes	70	180	85	125	90	165	85	180	80	160	85	165	90	215	80	170
Tunkhannock gravelly loam, 3 to 8 percent slopes	65	190	80	120	85	155	80	180	75	150	80	155	85	200	80	170
Tunkhannock gravelly loam, 8 to 15 percent slopes	55	140	70	105	75	140	70	170	65	140	65	135	75	190	75	160
Tunkhannock gravelly loam, 15 to 25 percent slopes	45	80	55	-----	55	-----	60	150	55	120	50	-----	50	-----	65	140
Volusia silt loam, 0 to 8 percent slopes	20	80	20	55	25	80	-----	-----	60	140	-----	-----	-----	-----	30	110
Watson gravelly silt loam, 0 to 8 percent slopes, moderately eroded	75	180	70	120	70	155	65	170	85	175	70	155	70	190	90	180
Watson silt loam, 0 to 3 percent slopes	70	170	65	120	65	150	60	160	80	165	60	145	70	190	85	180
Watson silt loam, 3 to 8 percent slopes, moderately eroded	75	180	70	125	75	165	70	170	85	185	65	155	75	200	90	190
Watson silt loam, 8 to 15 percent slopes, moderately eroded	75	180	70	125	75	165	75	180	85	175	65	155	75	200	85	180
Watson silty clay loam, 8 to 15 percent slopes, severely eroded	65	160	65	110	65	140	65	160	70	160	60	135	65	-----	70	160
Wurtsboro channery loam, 0 to 3 percent slopes	60	150	-----	-----	60	150	-----	-----	80	165	-----	-----	70	190	80	170
Wurtsboro channery loam, 3 to 8 percent slopes, moderately eroded	65	150	-----	-----	65	150	-----	-----	80	175	-----	-----	75	200	85	180

[1] Cow-acre-days is the number of days per year 1 acre will graze a cow without injury to the pasture.

Interpretations for Woodland

The natural vegetation of Carbon County was trees. Lumbering and clearing for farms took place late in the 18th and early in the 19th centuries. Since then, some of the cleared land has reverted to brush and trees. In the past, fires following cutting were common, and most woodlands were burned over repeatedly. Fires and continuous heavy cutting are the causes of the present poor condition of the woodland.

The present woodland consists of the following cover types:

	Percentage of woodland area
Chestnut oak	37
White oak	11
Red oak	13
Scrub oak	11
Oak-hard pine	3
Aspen-gray birch	15
Sugar maple-beech-yellow birch	5
Hemlock	2
Hard pine-oak	3
Total	100

Woodland consisting of seedlings, saplings, and poletimber makes up approximately 80 percent of the acreage in commercial forests. Sawtimber accounts for only 11 percent.

The woodland can be restored to productivity through the cooperation of owners, users, and the various State and Federal agencies. Fire prevention and control, together with proper management, can accomplish this goal. Preliminary studies of the growth rates of trees [1] growing on several extensive soils in 20 sample plots show that trees on the Pocono Plateau grow slowly. There are not enough data, however, to show the relative productivity of these soils.

The soil on which trees and associated vegetation grow is the place from which to start woodland management. Soils that have similar characteristics have been grouped into woodland suitability groups, and a list of the soils in each group is given. The features of the various woodland suitability groups are shown in table 2.

In table 2 trees that grow best on the soils of each group are listed in the order of priority. However, the species that are selected for planting depend on whether the trees are going to be harvested for pulpwood or for sawlogs and if the woodlands are to be managed for the production of wood products or for multiple uses.

The market for Christmas trees should be evaluated before the decision is made to grow this type of product for the annual trade.

In the table the heading, *Mortality of natural and planted seedlings*, refers to the expected degree of loss of natural seedlings or of planted nursery stock of proper grade, properly planted. The rating takes into account the normal environment of the site.

A rating of "slight" in the mortality column means the site has no special problems and that mortality would not exceed 25 percent of the stock planted. Normally, satisfactory restocking could be obtained by the first planting. As a rule, natural regeneration would be adequate. A rating of "moderate" means that a mortality of 25 to 50 percent can be expected on soils so rated. Some replanting will be needed after the first planting. Natural regeneration is not always adequate or timely. A rating of "severe" means that planting losses will be large and that a second or a third trial may be needed.

Competition from other plants refers to the degree of competition that can be expected because the planting site is invaded by brush, grass, and undesirable trees.

Limitation to the use of woodland equipment refers to soil characteristics and topographic features that interfere with, or prohibit the use of, equipment that is commonly used in harvesting trees or in the cultivation of seedlings. Steepness of slope, surface stones and boulders, and prolonged wetness of the soil are the main limitations in the use of equipment.

Hazard of erosion refers to the likelihood of erosion when the soil is managed according to currently acceptable conservation practices.

Hazard of windthrow refers to windfirmness as reflected by soil characteristics that control development of the root system of trees.

Hazard of insects and diseases refers to the possibility of damage from insects and of epidemics of diseases that would be injurious to the woodlands.

WOODLAND SUITABILITY GROUP 1

The soils in this group are acid, deep, well drained, and medium textured. They have developed in material from sandstone, siltstone, and shale on flood plains and on uplands that have slopes of as much as 8 percent. In this group are the following soils:

Allenwood gravelly loam and silt loam, 0 to 3 percent slopes.
Allenwood gravelly loam and silt loam, 3 to 8 percent slopes, moderately eroded.
Allenwood gravelly silt loam, 0 to 3 percent slopes.
Allenwood gravelly silt loam, 3 to 8 percent slopes, moderately eroded.
Conotton gravelly loam, 0 to 3 percent slopes.
Conotton gravelly loam, 3 to 8 percent slopes.
Fleetwood sandy loam, 0 to 3 percent slopes.
Fleetwood sandy loam, 3 to 8 percent slopes, moderately eroded.
Fleetwood very stony sandy loam, 0 to 8 percent slopes.
Hartleton channery silt loam, 0 to 3 percent slopes.
Hartleton channery silt loam, 3 to 8 percent slopes, moderately eroded.
Hartleton very stony loam, 0 to 8 percent slopes.
Hazleton loam, 0 to 3 percent slopes.
Hazleton loam, 3 to 8 percent slopes.
Hazleton loam, 3 to 8 percent slopes, moderately eroded.
Hazleton very stony loam, 0 to 8 percent slopes.
Laidig gravelly loam, 3 to 8 percent slopes, moderately eroded.
Laidig very stony loam, 3 to 8 percent slopes.
Meckesville channery loam, 0 to 3 percent slopes.
Meckesville channery loam, 3 to 8 percent slopes, moderately eroded.
Meckesville very stony loam, 0 to 8 percent slopes.
Swartswood channery silt loam, 0 to 8 percent slopes.
Swartswood very stony loam, 0 to 8 percent slopes.
Tioga fine sandy loam.
Tioga silt loam.
Tunkhannock gravelly loam, 0 to 3 percent slopes.
Tunkhannock gravelly loam, 3 to 8 percent slopes.

These soils have few limitations to proper woodland management. The pan in the Laidig and Swartswood soils increases the hazard of erosion and the difficulty of maintaining roads and trails.

[1] Data for the individual sample plots are on file in the Pennsylvania State Office of the Soil Conservation Service.

TABLE 2.—*Features of woodland suitability*

Woodland suitability group	Priority for reforestation
1. Deep, well-drained, medium-textured, acid soils on slopes of 0 to 8 percent	White pine, red pine, Norway spruce, larch, black locust.
2. Well-drained, medium-textured, acid soils on slopes of 8 to 25 percent	White pine, red pine, larch, Norway spruce, black locust.
3. Deep, moderately well-drained, medium-textured, acid soils on slopes of 0 to 25 percent.	White pine, red pine, Norway spruce, white spruce, larch, black locust, Virginia pine, pitch pine.
4. Deep, poorly drained to somewhat poorly drained, medium-textured soils on slopes of 0 to 8 percent.	White pine, red pine, Austrian pine, spruce, larch, black locust.
5. Deep, poorly drained to very poorly drained, medium- to light-textured, acid soils on slopes of 0 to 8 percent.	White pine, white spruce, hemlock
6. Shallow to moderately deep, well-drained, medium- to light-textured, acid soils on slopes of 0 to 8 percent.	White pine, red pine, Virginia pine, pitch pine, larch.
7. Shallow to moderately deep, well-drained, light- to medium-textured soils on slopes of 8 to 25 percent.	White pine, red pine, Virginia pine, pitch pine, larch.
8. Shallow to moderately deep, well-drained, stony soils on slopes steeper than 25 percent.	White pine, red pine, Virginia pine, pitch pine, larch.
9. Very shallow, well-drained to excessively drained, light- to medium-textured soils on slopes of 0 to 8 percent.	White pine, Virginia pine, pitch pine, red pine.
10. Very shallow and droughty, light- to medium-textured soils on slopes of 8 to 25 percent.	White pine, red pine, Virginia pine, pitch pine.
11. Very shallow, well-drained, medium-textured, acid soils on slopes steeper than 25 percent.	White pine, red pine, Virginia pine, pitch pine.
12. Miscellaneous land types having no continuous mantle of soil and occurring on variable slopes.	Not suitable for productive woodland
13. Level, very poorly drained soils that are too wet for productive stands of trees	Not suitable for productive woodland

WOODLAND SUITABILITY GROUP 2

The soils in this group are acid, well drained, and medium textured. They have developed in material from sandstone, siltstone, and shale on uplands that have slopes of 8 to 25 percent. In this group are:

Allenwood gravelly loam and silt loam, 8 to 15 percent slopes, moderately eroded.
Allenwood gravelly silt loam, 8 to 15 percent slopes, moderately eroded.
Allenwood gravelly silt loam, 15 to 25 percent slopes, moderately eroded.
Allenwood gravelly silty clay loam, 8 to 15 percent slopes, severely eroded.
Allenwood gravelly silty clay loam, 15 to 25 percent slopes, severely eroded.
Conotton gravelly loam, 15 to 25 percent slopes.
Fleetwood sandy loam, 8 to 15 percent slopes, moderately eroded.
Fleetwood very stony sandy loam, 8 to 25 percent slopes.
Hartleton channery silt loam, 8 to 15 percent slopes, moderately eroded.
Hartleton channery silt loam, 8 to 15 percent slopes, severely eroded.
Hartleton channery silt loam, 15 to 25 percent slopes, moderately eroded.
Hartleton channery silt loam, 15 to 25 percent slopes, severely eroded.
Hartleton very stony loam, 8 to 25 percent slopes.
Hazleton loam, 8 to 15 percent slopes, moderately eroded.
Hazleton very stony loam, 8 to 25 percent slopes.
Laidig gravelly loam, 8 to 15 percent slopes, moderately eroded.
Laidig gravelly loam, 15 to 25 percent slopes, severely eroded.
Laidig very stony loam, 8 to 25 percent slopes.
Meckesville channery loam, 8 to 15 percent slopes, moderately eroded.
Meckesville very stony loam, 8 to 25 percent slopes.
Swartswood channery silt loam, 8 to 15 percent slopes, moderately eroded.
Swartswood very stony loam, 8 to 25 percent slopes.
Tunkhannock gravelly loam, 8 to 15 percent slopes.
Tunkhannock gravelly loam, 15 to 25 percent slopes.

WOODLAND SUITABILITY GROUP 3

The soils in this group are acid, deep, moderately well drained, and medium textured. They have formed in material from sandstone, siltstone, and shale. These soils are on flood plains and on uplands that have slopes of as much as 25 percent. In this group are:

Albrights channery loam, 0 to 3 percent slopes.
Albrights channery loam, 3 to 8 percent slopes, moderately eroded.
Albrights silt loam, 0 to 3 percent slopes.
Albrights silt loam, 3 to 8 percent slopes, moderately eroded.
Albrights very stony loam, 0 to 8 percent slopes.
Albrights very stony loam, 8 to 25 percent slopes.
Buchanan gravelly loam, 3 to 10 percent slopes, moderately eroded.
Buchanan very stony loam, 0 to 8 percent slopes.
Buchanan very stony loam, 8 to 25 percent slopes.
Comly silt loam, 0 to 3 percent slopes.
Comly silt loam, 3 to 8 percent slopes, moderately eroded.
Comly silt loam, 8 to 15 percent slopes.
Comly silty clay loam, 8 to 15 percent slopes, severely eroded.
Comly very stony silt loam, 0 to 8 percent slopes.
Comly very stony silt loam, 8 to 25 percent slopes.
Drifton loam, 0 to 3 percent slopes.
Drifton loam, 3 to 8 percent slopes, moderately eroded.
Drifton very stony loam, 0 to 8 percent slopes.
Middlebury silt loam, 0 to 3 percent slopes.
Middlebury silt loam, 3 to 8 percent slopes.
Middlebury and Tioga silt loams, 0 to 3 percent slopes, severely eroded.
Pekin silt loam, 0 to 3 percent slopes.
Tioga and Middlebury very stony loams, 0 to 8 percent slopes.
Watson gravelly silt loam, 0 to 8 percent slopes, moderately eroded.

groups for woodland management

Suitability for production of Christmas trees	Mortality of natural and planted seedlings	Competition from other plants	Limitation to the use of woodland equipment	Hazard of		
				Erosion	Windthrow	Insects and diseases
White and Scotch pines, well suited; spruce, moderately well suited.	Slight	Severe	Slight	Slight to moderate.	Slight	Slight.
Scotch pine, well suited to moderately well suited; spruce, moderately well suited to poorly suited.	Slight	Moderate to severe.	Moderate	Moderate	Slight	Slight.
Scotch pine, well suited to moderately well suited; spruce, moderately well suited to poorly suited.	Slight	Moderate	Moderate	Slight to moderate.	Slight	Slight.
Scotch pine and spruce, moderately well suited.	Moderate	Moderate to severe.	Severe	Slight to moderate.	Moderate	Slight.
Scotch pine and spruce, not suited	Severe	Severe	Severe	Slight	Severe	Slight.
Scotch pine, well suited to moderately well suited; spruce, moderately well suited to poorly suited.	Slight to moderate.	Slight to moderate.	Slight	Slight	Slight	Slight.
Scotch pine, fairly to moderately well suited; spruce, poorly to moderately well suited.	Slight to moderate.	Slight	Moderate	Moderate	Slight	Slight.
Scotch pine and spruce, not suited	Slight to moderate.	Slight	Severe	Severe	Slight	Slight.
Scotch pine and spruce, not suited	Severe	Slight	Slight	Slight to moderate.	Slight	Slight.
Scotch pine and spruce, not suited	Severe	Slight	Moderate	Moderate	Slight	Slight.
Scotch pine and spruce, not suited	Severe	Slight	Severe	Severe	Slight	Slight.

Watson silt loam, 0 to 3 percent slopes.
Watson silt loam, 3 to 8 percent slopes, moderately eroded.
Watson silt loam, 8 to 15 percent slopes, moderately eroded.
Watson silty clay loam, 8 to 15 percent slopes, severely eroded.
Wurtsboro channery loam, 0 to 3 percent slopes.
Wurtsboro channery loam, 3 to 8 percent slopes, moderately eroded.
Wurtsboro very stony loam, 0 to 8 percent slopes.
Wurtsboro very stony loam, 8 to 25 percent slopes.

Occasional flooding and a moderately high water table in the Tioga and Middlebury soils sometimes limit the use of woodland equipment.

WOODLAND SUITABILITY GROUP 4

The soils in this group are deep, mostly poorly drained to somewhat poorly drained, and medium textured. They have developed in material from sandstone, siltstone, and shale and occur on uplands that have slopes of as much as 8 percent. In this group are:

Alvira gravelly silt loam, 0 to 8 percent slopes.
Alvira very stony silt loam, 0 to 8 percent slopes.
Alvira and Shelmadine silt loams, 0 to 3 percent slopes.
Alvira and Shelmadine silt loams, 3 to 8 percent slopes, moderately eroded.
Alvira and Shelmadine very stony silt loams, 0 to 8 percent slopes.
Andover very stony loam, 0 to 3 percent slopes.
Morris very stony silt loam, 0 to 8 percent slopes.
Natalie very stony loam, 0 to 8 percent slopes.
Shelmadine silt loam, 0 to 3 percent slopes.
Shelmadine silt loam, 3 to 8 percent slopes, moderately eroded.
Shelmadine very stony silt loam, 0 to 8 percent slopes.
Volusia silt loam, 0 to 8 percent slopes.
Volusia very stony loam, 0 to 8 percent slopes.

WOODLAND SUITABILITY GROUP 5

The soils in this group are acid, deep, and poorly drained to very poorly drained. They are medium to light textured. The soils have developed in materials from sandstone, siltstone, and shale. They are on flood plains and on uplands that have slopes of as much as 8 percent. In this group are:

Holly silt loam.
Lickdale and Tughill loams and silt loams, 0 to 3 percent slopes.
Lickdale and Tughill very stony loams, 0 to 8 percent slopes.
Norwich silt loam, 0 to 3 percent slopes.
Norwich silt loam, 3 to 8 percent slopes.
Norwich very stony loam, 0 to 8 percent slopes.

WOODLAND SUITABILITY GROUP 6

The soils in this group are acid, shallow to moderately deep, and well drained. They are medium to light textured. These soils have developed in material from sandstone, siltstone, and shale. They are on uplands that have slopes of as much as 8 percent. In this group are:

Dekalb very stony loam, 0 to 8 percent slopes.
Leck Kill channery silt loam, 0 to 3 percent slopes.
Leck Kill channery silt loam, 3 to 8 percent slopes, moderately eroded.
Leck Kill very stony loam, 0 to 8 percent slopes.
Lordstown very stony silt loam, 0 to 8 percent slopes.

WOODLAND SUITABILITY GROUP 7

The soils in this group are well drained, shallow to moderately deep, and light to medium textured. They have developed in material from sandstone, siltstone, and

shale and are on uplands having slopes of 8 to 25 percent. In this group are:

Dekalb very stony loam, 8 to 25 percent slopes.
Leck Kill channery silt loam, 8 to 15 percent slopes, moderately eroded.
Leck Kill channery silt loam, 8 to 15 percent slopes, severely eroded.
Leck Kill channery silt loam, 15 to 25 percent slopes, moderately eroded.
Leck Kill channery silt loam, 15 to 25 percent slopes, severely eroded.
Leck Kill very stony loam, 8 to 25 percent slopes.
Lordstown very stony silt loam, 8 to 25 percent slopes.

WOODLAND SUITABILITY GROUP 8

The soils in this group are shallow to moderately deep and well drained. They have developed in material from sandstone and shale and are on uplands having slopes that are steeper than 25 percent. In this group are:

Dekalb very stony loam, 25 to 100 percent slopes.
Leck Kill very stony loam, 25 to 100 percent slopes.
Lordstown very stony silt loam, 25 to 80 percent slopes.

WOODLAND SUITABILITY GROUP 9

The soils in this group are droughty, well drained, and very shallow. They are light to medium in texture. The soils have developed in material from shale, sandstone, and siltstone and are on uplands that have slopes of as much as 8 percent. Soils in this group are:

Fleetwood very stony loam, shallow, 0 to 8 percent slopes.
Klinesville channery silt loam, 3 to 8 percent slopes, moderately eroded.
Montevallo channery silt loam, 0 to 3 percent slopes.
Montevallo channery silt loam, 3 to 8 percent slopes, moderately eroded.
Montevallo channery silt loam, 3 to 8 percent slopes, severely eroded.
Rushtown shaly silt loam, 3 to 8 percent slopes.

WOODLAND SUITABILITY GROUP 10

The soils in this group are droughty and very shallow. They are light to medium in texture. The soils have formed in material from shale, siltstone, and sandstone. They are on uplands that have slopes of 8 to 25 percent. In this group are:

Fleetwood very stony loam, shallow, 8 to 25 percent slopes.
Klinesville channery silt loam, 8 to 15 percent slopes, moderately eroded.
Klinesville channery silt loam, 8 to 15 percent slopes, severely eroded.
Klinesville channery silt loam, 15 to 25 percent slopes, moderately eroded.
Klinesville channery silt loam, 15 to 25 percent slopes, severely eroded.
Klinesville very stony silt loam, 8 to 25 percent slopes.
Montevallo channery silt loam, 8 to 15 percent slopes, moderately eroded.
Montevallo channery silt loam, 8 to 15 percent slopes, severely eroded.
Montevallo channery silt loam, 15 to 25 percent slopes, moderately eroded.
Montevallo channery silt loam, 15 to 25 percent slopes, severely eroded.
Rushtown shaly silt loam, 8 to 15 percent slopes.
Rushtown shaly silt loam, 15 to 25 percent slopes.

WOODLAND SUITABILITY GROUP 11

The soils in this group are acid, well drained, and very shallow. They are medium textured. The soils have formed in material from shale and sandstone. They are on uplands that have slopes of more than 25 percent. In this group are:

Fleetwood very stony loam, shallow, 25 to 100 percent slopes.
Klinesville channery silt loam, 25 to 35 percent slopes, moderately eroded.
Klinesville channery silt loam, 25 to 35 percent slopes, severely eroded.
Klinesville channery silt loam, 35 to 80 percent slopes.
Klinesville channery silt loam, 35 to 80 percent slopes, severely eroded.
Klinesville very stony silt loam, 25 to 80 percent slopes.
Montevallo channery silt loam, 25 to 35 percent slopes, moderately eroded.
Montevallo channery silt loam, 25 to 35 percent slopes, severely eroded.
Montevallo channery silt loam, 35 to 100 percent slopes, eroded.
Rushtown shaly silt loam, 25 to 35 percent slopes.

WOODLAND SUITABILIT GROUP 12

This group consists of the following miscellaneous land types:

Made land.
Mine dumps.
Mine dumps, coal.
Riverwash.
Riverwash, coal.
Strip mines.
Very stony land, 0 to 8 percent slopes.
Very stony land, 8 to 25 percent slopes.
Very stony land, 25 to 120 percent slopes.

These land types do not support productive stands of trees.

WOODLAND SUITABILITY GROUP 13

The soils in this group are very poorly drained. They are:

Muck and Peat.
Papakating silty clay loam.

These soils are too wet to support productive stands of trees.

Engineering Properties of the Soils [2]

This soil survey report for Carbon County, Pa., contains information that can be used by engineers to—

1. Make soil and land use studies that will aid in the selection and development of industrial, business, residential, and recreational sites.
2. Make preliminary estimates of the engineering properties of soils in planning agricultural drainage systems, farm ponds, irrigation systems, and diversion terraces.

[2] This section was prepared in cooperation with the Pennsylvania Department of Highways. Frank Brower, conservation engineer, and Elmer Gain, drainage engineer, Soil Conservation Service, helped prepare the section.

3. Make reconnaissance surveys of soil and ground conditions that will aid in locating highways and airports and in planning detailed soil surveys for their intended locations.
4. Locate sources of sand and gravel.
5. Correlate pavement performance with types of soil and thus develop information that will be useful in designing and maintaining pavements.
6. Determine the suitability of soil units for cross-country movement of vehicles and construction equipment.
7. Supplement information obtained from other published maps and reports and aerial photographs, for the purpose of making soil maps and reports that can be used readily by engineers.
8. Estimate the suitability of sites for settling pools, silting basins, and other means of disposing of coal wash.
9. Estimate the nature of material encountered when excavating for buildings and other structures.
10. Determine the suitability of soils for drainage and septic tanks.

The mapping and the descriptive report are somewhat generalized, however, and should be used only in planning more detailed field surveys to determine the in-place conditions of the soil at the site of the proposed engineering construction.

Some of the terms used by the soil scientist may be unfamiliar to the engineer, and some words—for example, soil, clay, silt, sand—have special meanings in soil science. These and other terms used in the report are defined in the Glossary at the end of the report.

Soil test data

To be able to make the best use of the soil maps and soil survey reports, the engineer should know the physical properties of the soil material and the in-place condition of the soil. After testing soil materials and observing their behavior in engineering structures, the engineer can develop design recommendations for the soil units delineated on the maps.

Several samples for each of eight of the major soil types in Carbon County were tested according to standard procedures to help evaluate the soils for engineering purposes (table 3). The engineering classifications in table 3 are based on data obtained by mechanical analyses and by tests to determine liquid limits and plastic limits. The mechanical analyses were made by combined sieve and hydrometer methods. Percentages of clay obtained by the hydrometer method should not be used in naming textural classes for soil classification.

The liquid limit and plastic limit tests measure the effect of water on the consistence of soil material. As the moisture content of a clayey soil increases from a very dry state, the material changes from a solid to a semisolid or plastic state. As the moisture content is further increased, the material changes from the plastic to a liquid state. The plastic limit is the moisture content at which the soil material passes from a solid to a plastic state. The liquid limit is the moisture content at which the material passes from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is in a plastic condition.

Table 3 also gives compaction (moisture-density) data for the tested soils. If a soil material is compacted at successively higher moisture contents, assuming that the compactive effort remains constant, the density of the compacted material will increase until the "optimum moisture content" is reached. After that, the density decreases with increase in moisture content. The highest dry density obtained in the compaction test is termed "maximum dry density." Moisture-density data are important in earthwork, for, as a rule, optimum stability is obtained if the soil is compacted to about the maximum dry density when it is at approximately the optimum moisture content.

Engineering classification systems

Most highway engineers classify soil materials according to the system approved by the American Association of State Highway Officials (*1*).[3] In this system soil materials are classified in seven principal groups The groups range from A–1, which is gravelly soil of high bearing capacity, to A–7, which consists of clay soil having low strength when wet. In each group the relative engineering value of the soil material is indicated by a group index number. Group index numbers range from 0 for the best materials to 20 for the poorest. The group index number is shown in parentheses, following the soil group symbol, in the next to last column in table 3.

Some engineers prefer to use the Unified soil classification system (*29*). In this system, soil materials are identified as coarse grained, 8 classes; fine grained, 6 classes; and highly organic soils. An approximate classification of soils by this system can be made in the field. The last column in table 3 shows the classification of the Carbon County soils tested according to the Unified system.

[3] Italicized numbers in parentheses refer to Literature Cited, page 105.

TABLE 3.—*Engineering*

Soil name and location	Parent material	Pennsylvania report No.	Depth from surface	Horizon	Moisture-density [2]	
					Maximum dry density	Optimum moisture
			Inches		*Lb. per cu. ft.*	*Percent*
Allenwood gravelly silt loam:						
120 feet S. of Route 443, 4½ miles W. of Lehighton Bridge. (Modal profile.) (S58-Pa. 13-7-4 and 13-7-7.)	Glacial till	BB-28608	18-25	B_{22}	115	16
		BB-28609	36-43	C_1	113	17
In Palmerton, 75 feet E. of intersection of Columbia Avenue and Eighth Street. (Heavy plastic subsoil.)	Glacial till	BC-1540	17-32	B_{22}	106	19
		BC-1541	38-55	C_1	106	18
Along Route 443, 1 mile W. of Lehighton. (More gravelly and loamy.)	Glacial till	BC-1534	29-39	B_{22}	118	13
		BC-1535	52-64	C_1	119	14
Allenwood gravelly silt loam:						
In field NW. of intersection of Routes 13025 and 13029. (Modal profile.) (S57-Pa. 13-10-3 and 13-10-5.)	Glacial till (Jerseyan).	BB-28612	15-22	B_{21}	115	14
		BB-28613	31-39	B_3	114	15
On E. edge of Weatherly Borough. (Plastic B horizon.)	Glacial till (Illinoian).	BC-1530	29-49	B_{23}	102	22
		BC-1531	63-84	B_3	99	23
Middle of S. side of Broad Mountain. (Most friable B horizon.)	Glacial till	BC-1532	16-25	B_2	122	11
		BC-1533	25-42	C_1	124	12
Dekalb very stony loam:						
On N. boundary line of Jim Thorpe Borough. (Modal profile.) (S57-Pa. 13-21-4 and 13-21-5.)	Pocono sandstone	BC-1240	16-25	B_3	127	10
		BC-1241	25-38	C_1	124	10
Shalepit N. of Stony Creek Hotel in Penn Forest Township. (Most shaly and silty.)	Siltstone, sandstone, and shale.	BC-1244	15-22	B_3	116	14
		BC-1245	22-36	C_1	121	12
On N. slope of Broad Mountain along Highway 29. (Most sandy.)	Glacial till	BC-1239	7-16	B_3	126	10
		BC-1248	16-34	C_1	128	9
Drifton very stony loam:						
4 miles NE. of Jim Thorpe on Route 903. (Modal profile.) (S57-Pa. 13-5-5 and 13-15-7.)	Glacial till	BC-1233	19-27	B_{22g}	122	11
		BC-1234	33-40	C_1	124	10
Near W. end of Unionville. (Most poorly drained.)	Glacial till	BC-1720	14-25	B_{22}	110	17
		BC-1721	34-50+	C_1	111	15
On N. side of Broad Mountain. (Sandiest; more stony.)	Glacial till	BC-1722	18-23	B_{23g}	120	11
		BC-1723	23-29	C_1	126	9
Hartleton channery silt loam:						
Intersection of blacktop and Route 309 in Towamensing Township. (Modal profile.) (S57-Pa. 13-1-4 and 13-1-6.)	Glacial till (Jerseyan).	BB-28602	20-28	B_{22}	124	10
		BB-28603	32-40	C_1	121	12
1.5 miles S. of Route 209 and E. of Route 13016 in Towamensing Township. (Heaviest B horizon.)	Glacial till (Jerseyan).	BB-28616	19-27	B_{22}	119	13
		BB-28617	31-38	C_1	117	14
1 mile SW. of Lehighton on road to Ashfield. (Most channery and loamy.)	Glacial till (Jerseyan).	BC-1526	22-29	B_{22}	121	11
		BC-1527	33-41	C_1	120	12
Hazleton very stony loam:						
On Broad Mountain near Route 29. (Modal profile.) (S57-Pa. 13-9-6 and 13-9-8.)	Glacial till (Jerseyan).	BB-28610	20-30	B_{22}	119	14
		BB-28611	38-44	C_1	122	12
Along Route 903 in Penn Forest Township, ½ mile SW. of company farm. (Strong B horizon.)	Glacial till (Illinoian).	BC-1242	24-36	B_{22}	114	16
		BC-1243	42-54	C_1	110	17
Along road to Hickory Run Park, ½ mile W. of Heimbach's Farm. (Sandy; many stones.)	Glacial till (Illinoian).	BC-1246	10-22	B_{22}	125	10
		BC-1247	29-37	C_1	126	9

See footnotes at end of table.

test data [1]

Mechanical analysis [3]																	Liquid limit	Plasticity index	Classification	
Discarded part (estimated) of field sample larger than 3 inches	Percentage passing sieve—[4]										Percentage smaller than—[4]								AASHO [5]	Unified [6]
	3 in.	2 in.	1½ in.	1 in.	¾ in.	⅜ in.	No. 4 (4.76 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.						
Percent																				
			100	99	93	80	74	68	56	48	47	42	30	24	36	14	A-6(4)	GC-SC.
		100	90	80	73	66	60	55	45	31	30	26	20	18	36	14	A-2-6(1)	GC.
5		100	87	71	68	64	61	58	51	46	46	40	30	25	44	13	A-7-5(3)	GM.
	100	83	83	83	69	65	62	58	49	42	40	37	29	24	48	18	A-7-5(4)	GM.
	100	82	82	76	75	63	48	35	23	15	14	12	9	7	25	7	A-2-4(0)	GM-GC.
			100	95	91	86	75	58	39	21	20	18	13	11	21	2	A-1-b(0)	SM.
			100	97	91	85	78	70	64	55	52	38	24	19	30	8	A-4(4)	ML-CL.
			100	93	90	87	85	81	73	64	60	48	30	23	31	8	A-4(6)	ML-CL.
				100	98	98	98	97	94	85	82	76	65	55	42	12	A-7-5(9)	ML.
			100	94	92	88	87	86	82	73	73	67	52	43	44	13	A-7-5(10)	ML.
		100	92	89	88	82	76	70	58	40	38	31	21	16	24	6	A-4(1)	SM-SC.
		100	92	90	80	72	66	61	50	30	28	23	16	12	21	2	A-2-4(0)	GM.
15			100	98	96	87	77	69	53	30	29	24	17	13	23	5	A-2-4(0)	SM-SC.
15		100	87	87	76	69	62	56	43	28	27	22	16	12	26	9	A-2-4(0)	GC.
40	100	78	72	66	51	42	33	27	24	20	20	16	11	9	30	7	A-2-4(0)	GM-GC.
40	100	82	71	52	41	25	19	16	12	10	9	7	4	3	28	6	A-1-a(0)	GP-GC.
10			100	85	84	80	75	71	53	30	29	25	16	13	21	4	A-2-4(0)	SM-SC.
10		100	80	80	75	71	68	64	48	26	25	21	14	11	19	3	A-2-4(0)	SM.
	100	76	67	63	60	53	48	46	41	25	23	18	11	9	22	3	A-1-b(0)	GM.
	100	85	85	70	62	57	54	51	46	27	26	20	14	8	19	5	A-2-4(0)	GM-GC.
			100	95	90	88	86	83	78	69	67	56	38	27	32	9	A-4(7)	ML-CL.
			100	95	92	86	84	81	76	67	65	54	39	28	33	10	A-4(6)	ML-CL.
		100	90	83	82	79	77	75	60	41	39	31	21	15	24	5	A-4(1)	SM-SC.
		100	91	91	85	82	81	79	61	37	35	30	17	11	18	1	A-4(0)	SM.
	100	92	92	79	72	48	35	28	24	12	11	7	5	4	20	0	A-1-a(0)	GP-GM.
			100	88	70	53	44	36	28	17	14	11	6	5	20	1	A-1-b(0)	GM.
		100	95	93	88	73	58	48	42	36	33	26	15	12	27	6	A-4(0)	GM-GC.
	100	93	93	77	72	62	52	44	38	34	30	25	15	12	29	8	A-2-4(0)	GM-GC.
	100	83	69	51	43	31	26	20	14	12	11	8	5	4	27	6	A-1-a(0)	GP-GC.
	100	84	73	48	44	28	22	17	14	12	10	7	4	3	25	4	A-1-a(0)	GP-GM.
			100	92	89	78	73	68	58	42	41	32	20	15	30	7	A-4(1)	SM-SC.
			100	89	88	83	78	74	56	36	35	30	22	17	30	9	A-4(0)	SM-SC.
	100	82	82	75	72	70	68	67	64	45	42	36	29	25	32	11	A-6(2)	GC.
					100	99	98	97	94	66	63	57	47	43	35	12	A-6(7)	ML-CL.
	100	87	87	79	75	70	66	61	45	27	26	22	15	11	22	4	A-2-4(0)	SM-SC.
	100	83	83	73	69	65	64	63	48	28	27	22	15	12	18	3	A-2-4(0)	GM-SM.

TABLE 3.—*Engineering*

Soil name and location	Parent material	Pennsylvania report No.	Depth from surface	Horizon	Moisture-density [2]	
					Maximum dry density	Optimum moisture
			Inches		*Lb. per cu. ft.*	*Percent*
Klinesville channery silt loam:						
1.5 miles S. of Forest Inn in Towamensing Township. (Modal profile.) (S57-Pa. 13–4–2 and 13–4–3.)	Glacial till (Jerseyan).	BB–28606	5–13	B_3	122	12
		BB–28607	13–20	C_1	116	16
300 feet W. of Hudsondale in Packer Township. (Most shaly.)	Glacial till (Jerseyan).	BC–1237	9–18	B_3	134	9
		BC–1238	18–28	C_1	132	8
2 miles NW. of Bowmanstown in Mahoning Township. (Shallow; approaching stony.)	Glacial till (Jerseyan).	BC–1536	9–18	B_3	112	14
		BC–1537	18–31	C_1	[7]	[7]
Montevallo channery silt loam:						
1 mile S. of Forest Inn. (Modal profile.) (S57-Pa. 13–3–2 and 13–3–3.)	Glacial till (Jerseyan).	BB–28604	5–12	B_3	[7]	[7]
		BB–28605	12–23	C_1	[7]	[7]
1 mile W. of Bowmanstown. (Least channery.)	Glacial till (Jerseyan).	BC–1538	11–27	B_3	116	15
		BC–1539	27–40	C_1	118	14
Near N. end of Long Run; ¼ mile from junction with Lehigh River. (Most channery.)	Glacial till	BC–1528	2–7	B_{21r}	85	30
		BC–1529	7–26	C_1	127	11
Watson silt loam:						
Along Route 13025 in Packer Township, opposite airport. (Modal profile.) (S57-Pa. 13–11–5 and 13–11–8.)	Glacial till	BB–28614	22–30	B_{23g}	116	13
		BB–28615	41–53	C_1	115	14
0.75 mile SW. of Gerner's Station in East Penn Township. (Most plastic.)	Glacial till	BC–1542	21–31	B_{22g}	115	14
		BC–1543	35–42	C_1	116	14
On E. edge of Weatherly Borough Road to Rockport. (Most loamy.)	Glacial till	BC–1235	20–28	B_{22g}	118	14
		BC–1236	32–42	C_1	115	16

[1] Tests were performed by the Pennsylvania Department of Highways according to standard procedures of the American Association of State Highway Officials (AASHO) (*1*).

[2] Moisture-density test was performed according to Method A, AASHO designation T 99–57.

[3] According to AASHO designation T 88. Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method, and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method, and the material coarser

Engineering data and recommendations

Table 4 contains a brief description of the soils mapped in Carbon County and gives their estimated engineering classifications and physical properties. Additional information about the Carbon County soils is in the sections "Descriptions of the Soils" and "Use and Management of the Soils."

The engineering data in table 4 are based on the soil tests shown in table 3, on information in other parts of the soil survey report, and on experience with the same kinds of soils in other counties.

"Depth from the surface" is that which is average, or typical, of the whole series under land use normal for this county. The various estimates in succeeding columns are approximately average values for the specific layer of the typical soil. Considerable variation from these average

test data [1]—Continued

Mechanical analysis [3]																		
Discarded part (estimated) of field sample larger than 3 inches	Percentage passing sieve—[4]										Percentage smaller than—[4]				Liquid limit	Plasticity index	Classification	
	3 in.	2 in.	1½ in.	1 in.	¾ in.	⅜ in.	No. 4 (4.76 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.			AASHO [5]	Unified [6]
Percent																		
5	-----	-----	100	73	63	43	31	20	12	10	10	9	6	4	33	9	A–2–4(0)	GP–GC.
30	-----	100	87	66	56	25	16	11	7	5	5	5	3	2	31	6	A–1–a(0)	GW–GM.
-----	100	88	84	70	60	44	34	19	6	4	4	4	3	3	29	7	A–2–4(0)	GW.
-----	-----	100	89	81	68	61	53	29	9	4	4	4	3	3	20	1	A–1–a(0)	SW.
-----	-----	100	76	42	35	29	24	21	16	11	11	10	6	5	30	4	A–1–a(0)	GP–GM.
-----	100	62	40	10	8	5	4	4	3	2	2	2	1	1	28	5	A–1–a(0)	GP.
-----	100	83	64	47	41	31	24	21	14	12	12	10	7	4	40	6	A–1–a(0)	GP–GM.
-----	100	80	56	31	22	11	6	3	2	1	1	1	1	1	41	12	A–2–7(0)	GP.
-----	-----	-----	----	100	99	95	66	34	15	11	11	9	6	4	47	17	A–2–7(0)	SP–SM.
-----	-----	-----	----	----	100	93	63	30	14	10	10	9	6	4	41	9	A–2–5(0)	SP–SM.
15	-----	100	86	52	45	23	15	10	8	6	5	4	2	2	88	1	A–1–a(0)	GW–GM.
5	-----	-----	100	89	80	61	39	14	5	4	4	4	3	2	36	5	A–1–a(0)	GP.
-----	-----	-----	100	97	97	94	90	85	79	64	57	44	30	23	29	8	A–4(6)	ML–CL.
-----	-----	-----	100	92	89	85	82	78	74	59	53	40	27	22	29	8	A–4(5)	ML–CL.
5	-----	100	92	92	85	81	79	77	70	53	49	43	33	26	33	10	A–4(4)	ML–CL.
5	-----	-----	----	100	97	93	92	88	82	62	57	49	37	30	35	12	A–6(6)	ML–CL.
10	100	73	73	70	68	64	60	56	47	34	33	28	19	16	31	9	A–2–4(0)	GM–GC.
15	-----	100	79	69	67	63	61	58	47	32	31	28	24	22	39	14	A–2–6(1)	GM–GC.

than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soils.

[4] Based on sample as received in the laboratory. Laboratory test data not corrected for amount discarded in field sampling.

[5] Based on Standard Specifications for Highway Materials and Methods of Sampling and Testing (pt. 1, ed. 7): The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes. AASHO Designation M 145–49.

[6] Based on the Unified Soil Classification System, Tech. Memo. No. 3–357, v. 1, Waterways Expt. Sta., Corps of Engin., March 1953 (*29*).

[7] Insufficient No. 4 material for moisture-density test.

values should be anticipated. Estimates of some properties are not given for the upper layer because the material from this layer is usually unsuitable for use in many engineering structures and is commonly used for topdressing shoulders and slopes of roads to promote the growth of vegetation.

Table 5 shows the characteristics and estimated suitabilities of the soil series in Carbon County as material in engineering construction. The characteristics listed are those that cause difficulty in the stated kind of construction. Additional information about the soils can be obtained in the section "Descriptions of the Soils."

TABLE 4.—*Descriptions of Carbon County soils and their*

Soil symbol [1]	Soil name	Depth to seasonally high water table	Depth to bedrock	Description of site and soil
		Inches	*Feet*	
AaA	Albrights channery loam, 0 to 3 percent slopes.	18	3–30	Upland. Three or more feet of moderately well drained silt loam, loam, or stony loam with a weak pan. Soils have developed in glacial till derived from sandstone, siltstone, and shale. The very stony phases have stones and boulders up to 3 feet in diameter on the surface and throughout the profile. These soils in a few areas have a clay substratum.
AaB2	Albrights channery loam, 3 to 8 percent slopes, moderately eroded.			
AbA	Albrights silt loam, 0 to 3 percent slopes.			
AbB2	Albrights silt loam, 3 to 8 percent slopes, moderately eroded.			
AcB	Albrights very stony loam, 0 to 8 percent slopes.			
AcD	Albrights very stony loam, 8 to 25 percent slopes.			
AdA	Allenwood gravelly loam and silt loam, 0 to 3 percent slopes.	36+	4–150+	Upland. Four feet or more of well-drained gravelly loam to gravelly silty clay loam. Soils have developed in pre-Wisconsin glacial till derived from sandstone, siltstone, shale, and quartzite. Some areas are 20 percent cobbles and small boulders; most areas have occasional cobbles.
AdB2	Allenwood gravelly loam and silt loam, 3 to 8 percent slopes, moderately eroded.			
AdC2	Allenwood gravelly loam and silt loam, 8 to to 15 percent slopes, moderately eroded.			
AgD2	Allenwood gravelly silt loam, 15 to 25 percent slopes, moderately eroded.			
AmC3	Allenwood gravelly silty clay loam, 8 to 15 percent slopes, severely eroded.			
AmD3	Allenwood gravelly silty clay loam, 15 to 25 percent slopes, severely eroded.			
AgA	Allenwood gravelly silt loam, 0 to 3 percent slopes.	36+	4–150	Upland. Four feet or more of well-drained gravelly loam to gravelly silty clay loam. Soils have developed in pre-Wisconsin glacial till derived from sandstone, siltstone, shale, and quartzite. Some areas are 20 percent cobbles and small boulders; most areas have occasional cobbles.
AgB2	Allenwood gravelly silt loam, 3 to 8 percent slopes, moderately eroded.			
AgC2	Allenwood gravelly silt loam, 8 to 15 percent slopes, moderately eroded.			
AnB	Alvira gravelly silt loam, 0 to 8 percent slopes.	0	3–18	Upland. Three feet or more of somewhat poorly drained to poorly drained gravelly or stony silt loam to silty clay loam with hardpan. Soils have developed in pre-Wisconsin glacial till derived from sandstone, shale, and siltstone. Surface layer in some areas is extremely stony.
ArB	Alvira very stony silt loam, 0 to 8 percent slopes.			
AsA	Alvira and Shelmadine silt loams, 0 to 3 percent slopes.			
AsB2	Alvira and Shelmadine silt loams, 3 to 8 percent slopes, moderately eroded.			
AtB	Alvira and Shelmadine very stony silt loams, 0 to 8 percent slopes.			
AvA	Andover very stony loam, 0 to 3 percent slopes.	0	4–20	Four feet or more of poorly drained to very poorly drained stony loam to sandy clay loam. Soil has developed in pre-Wisconsin glacial till and colluvium derived from gray sandstone and conglomerate. Surface is stony to very stony; small areas of silt loam are included.
BcB2	Buchanan gravelly loam, 3 to 10 percent slopes, moderately eroded.	18	4–30	Lower slopes. Four feet or more of moderately well drained to somewhat poorly drained gravelly or stony loam with fragipan. Soils have developed in colluvium derived from sandstone, siltstone, and shale. Stones and pebbles are present throughout profile; very stony phases have them on the surface.
BnB	Buchanan very stony loam, 0 to 8 percent slopes.			
BhD	Buchanan very stony loam, 8 to 25 percent slopes.			

See footnotes at end of table.

estimated engineering soil classifications and physical properties

Depth of layers and estimated engineering soil classifications			Percentage passing sieve—			Estimated properties of soil layers					
									Moisture-density [2]		
From surface	Unified	AASHO	No. 200 (0.074 mm.)	No. 10 (2.0 mm.)	No. 4 (4.7 mm.)	Permeability	Water-holding capacity	pH	Optimum moisture	Maximum dry density	Shrink-swell potential
Inches						*In./hr.*	*Inches*		*Percent*	*Lbs /cu. ft.*	
0–10						0.63–2.0	2.0	5.0			
10–36	ML, CL	A–4	60	85	90	0.2–0.63	4.0	5.0	13	115	Low.
36–72	ML, CL	A–4	55	80	85	0.2–0.63	6.0	5.0	14	115	Low.
0–10							2.0	6.4			
10–25	SC or GC	A–6	48	68	74	0.63–2.0	3.0	5.4	16	115	Low.
25–96	GC	A–2	31	55	60	0.63–2.0	12.0	5.0	17	112	Low.
0–10						2.0–6.3	2.5	6.4			
10–31	ML–CL	A–4	55	70	78	0.63–2.0	4.3	6.2	14	115	Low.
31–44	ML–CL	A–4	64	81	85	0.63–2.0	4.0	4.2	15	115	Low.
0–10						0.63–2.0	2.0	5.0			
10–36	ML, CL	A–4	60	80	85	0.2–0.63	4.0	5.0	15	112	Low.
36–96	ML, CL	A–4	55	75	80	0.2–0.63	10.0	5.0	15	112	Low.
0–8						2.0–6.3	1.5	5.0			
8–30	GM	A–2	30	40	45	<0.2	3.0	5.0	15	120	Low.
30–120	GM	A–2	30	40	45	<0.2	13.0	5.0	15	120	Low.
0–10						2.0–6.3	1.7	5.0			
10–36	GM	A–2	30	50	55	0.63–2.0	4.0	5.0	15	112	Low.
36–95	GM	A–2	35	55	60	0.63–2.0	10.0	5.0	15	112	Low.

TABLE 4.—*Descriptions of Carbon County soils and their estimated*

Soil symbol [1]	Soil name	Depth to seasonally high water table	Depth to bedrock	Description of site and soil
		Inches	*Feet*	
CmA	Comly silt loam, 0 to 3 percent slopes.	18	2–6	Lower upland slopes. Two feet or more of moderately well drained to somewhat poorly drained silt loam and stony silt loam to silty clay loam with clay. Soils have developed in pre-Wisconsin glacial till derived from shale and siltstone. Stony areas are mostly immediately north of Stony Ridge.
CmB2	Comly silt loam, 3 to 8 percent slopes, moderately eroded.			
CmC	Comly silt loam, 8 to 15 percent slopes.			
CnC3	Comly silty clay loam, 8 to 15 percent slopes, severely eroded.			
CoB	Comly very stony silt loam, 0 to 8 percent slopes.			
CoD	Comly very stony silt loam, 8 to 25 percent slopes.			
CtA	Conotton gravelly loam, 0 to 3 percent slopes.	48+	4–15	Alluvial terraces above flood levels. Four feet or more of well-drained gravelly loam to gravelly silt loam. Soils have developed in glacial outwash derived from sandstone, siltstone, and shale. Cobbles are at a depth of 24 inches.
CtB	Conotton gravelly loam, 3 to 8 percent slopes.			
CtD	Conotton gravelly loam, 15 to 25 percent slopes.			
DeB	Dekalb very stony loam, 0 to 8 percent slopes.	36+	2–3	Two to 3 feet of well-drained loam and sandy loam. Soils have developed from pre-Wisconsin glacial till derived principally from sandstone, conglomerate, and some shale. Stones and boulders, from 10 inches to 10 feet in diameter, are on and in the soil.
DeD	Dekalb very stony loam, 8 to 25 percent slopes.			
DeF	Dekalb very stony loam, 25 to 100 percent slopes.			
DrA	Drifton loam, 0 to 3 percent slopes.	24	4–25	Four feet or more of moderately well drained loam and silt loam. Soils have developed from compact, pre-Wisconsin glacial till derived from sandstone, siltstone, shale, and conglomerate. Stones and boulders occur occasionally in substratum. Very stony phase has boulders and stones, 10 inches to 3 feet in diameter, on and in the soil.
DrB2	Drifton loam, 3 to 8 percent slopes, moderately eroded.			
DsB	Drifton very stony loam, 0 to 8 percent slopes.			
FtA	Fleetwood sandy loam, 0 to 3 percent slopes.	60+	3–20	Three feet or more of well-drained sandy loam. Soils have developed from pre-Wisconsin glacial till derived mainly from quartzite and quartzite conglomerate. Some stones and boulders occur in substratum. Very stony phases have stones and boulders, 10 inches to 3 feet in diameter, on and in the soil.
FtB2	Fleetwood sandy loam, 3 to 8 percent slopes, moderately eroded.			
FtC2	Fleetwood sandy loam, 8 to 15 percent slopes, moderately eroded.			
FwB	Fleetwood very stony sandy loam, 0 to 8 percent slopes.			
FwD	Fleetwood very stony sandy loam, 8 to 25 percent slopes.			
FvB	Fleetwood very stony loam, shallow, 0 to 8 percent slopes.	36+	1–3	One to 3 feet of well-drained stony loam and stony sandy loam. Soils have developed from pre-Wisconsin glacial till derived mainly from quartzite and quartzitic conglomerate. Sandstone and boulders, 10 inches to 5 feet in diameter, are on and in the soil.
FvD	Fleetwood very stony loam, shallow, 8 to 25 percent slopes.			
FvF	Fleetwood very stony loam, shallow, 25 to 100 percent slopes.			
HaA	Hartleton channery silt loam, 0 to 3 percent slopes.	48+	4–8	Four or more feet of well-drained channery loam and silt loam. Soils have developed from pre-Wisconsin glacial till derived from thin-bedded, acid shale, some siltstone, and sandstone. Small to moderate amounts of channery fragments are on and in the soil. The very stony phases have scattered sandstone and quartzite boulders up to 3 feet in diameter on the surface.
HaB2	Hartleton channery silt loam, 3 to 8 percent slopes, moderately eroded.			
HaC2	Hartleton channery silt loam, 8 to 15 percent slopes, moderately eroded.			
HaC3	Hartleton channery silt loam, 8 to 15 percent slopes, severely eroded.			
HaD2	Hartleton channery silt loam, 15 to 25 percent slopes, moderately eroded.			
HaD3	Hartleton channery silt loam, 15 to 25 percent slopes, severely eroded.			
HsB	Hartleton very stony loam, 0 to 8 percent slopes.			
HsD	Hartleton very stony loam, 8 to 25 percent slopes.			

See footnotes at end of table.

engineering soil classifications and physical properties—Continued

Depth of layers and estimated engineering soil classifications			Percentage passing sieve—			Estimated properties of soil layers					
From surface	Unified	AASHO	No. 200 (0.074 mm.)	No. 10 (2.0 mm.)	No. 4 (4.7 mm.)	Permeability	Water-holding capacity	pH	Moisture-density [2]		Shrink-swell potential
									Optimum moisture	Maximum dry density	
Inches						*In./ft.*	*Inches*		*Percent*	*Lbs./cu. ft.*	
0–10						2. 0–6. 3	2. 0	5. 0			
10–36	ML, CL	A–4	60	85	90	0. 63–2. 0	4. 0	5. 0	13	115	Low.
36–72	ML, CL	A–4	55	80	85	0. 63–2. 0	6. 0	5. 0	14	115	Low.
0–12						2. 0–6. 3	2. 5	5. 0			
12–36	GM, SM	A–2	25	50	60	0. 63–2. 0	4. 0	5. 0	14	120	Low.
36–120	GM	A–1	15	35	40	2. 0–6. 3	10. 0	5. 0	14	120	Low.
0–7						2. 0–6. 3	1. 0	4. 9			
7–24	SC–SM	A–2	25	57	65	2. 0–6. 3	2. 25	4. 8	10	127	Low.
24–36	SC, GC	A–2	24	46	53	2. 0–6. 3	1. 5	4. 8	10	124	Low.
0–8						0. 63–2. 0	1. 5	4. 6			
8–27	GM	A–1	22	42	44	0. 2–0. 63	3. 5	5. 5	11	122	Low.
27–40	GM–GC	A–2	24	45	49	0. 2–0. 63	2. 0	5. 2	10	124	Low.
0–8						2. 0 –6. 3	1. 0	4. 5	12	120	Low.
8–30	GM, SM	A–2	20	35	50	2. 0 –6. 3	3. 5	4. 5	12	120	Low.
30–60	GM, SM	A–2	20	35	50	2. 0 –6. 3	4. 5	4. 5	12	120	Low.
0–8							1. 4	4. 5			
8–24	GM–SM	A–2	20	35	50	2. 0 –6. 3	1. 75	4. 5	12	120	Low.
0–8						2. 0 –6. 3	1. 5	6. 8			
8–32	GP–GM	A–1	12	28	35	0. 63–2. 0	5. 0	5. 5	10	124	Low.
32–40	GM	A–1	17	36	44	0. 63–2. 0	1. 5	5. 2	12	121	Low.

TABLE 4.—*Descriptions of Carbon County soils and their estimated*

Soil symbol [1]	Soil name	Depth to seasonally high water table	Depth to bedrock	Description of site and soil
		Inches	*Feet*	
HtA	Hazleton loam, 0 to 3 percent slopes.	36+	4–25	Upland. Four feet or more of well-drained loam and stony loam to silty clay loam. Soils have developed in pre-Wisconsin glacial till derived from gray sandstone, shale, and siltstone. Some areas are extremely stony. Most of the loam phases, except in wooded areas, have been cleared of stones.
HtB	Hazleton loam, 3 to 8 percent slopes.			
HtB2	Hazleton loam, 3 to 8 percent slopes, moderately eroded.			
HtC2	Hazleton loam, 8 to 15 percent slopes, moderately eroded.			
HvB	Hazleton very stony loam, 0 to 8 percent slopes.			
HvD	Hazleton very stony loam, 8 to 25 percent slopes.			
Hy	Holly silt loam.	0	4–10	Four feet or more of poorly drained silt loam to sandy loam. Soil has developed in alluvium.
KcB2	Klinesville channery silt loam, 3 to 8 percent slopes, moderately eroded.	36+	½–1½	Glaciated upland. One-half foot to 1.5 feet of well-drained channery silt loam and loam. Soils have developed on steeply folded, reddish siltstone and shale. Very stony phases occur at the bases of higher mountains and have scattered sandstone boulders on the surface.
KcC2	Klinesville channery silt loam, 8 to 15 percent slopes, moderately eroded.			
KcC3	Klinesville channery silt loam, 8 to 15 percent slopes, severely eroded.			
KcD2	Klinesville channery silt loam, 15 to 25 percent slopes, moderately eroded.			
KcD3	Klinesville channery silt loam, 15 to 25 percent slopes, severely eroded.			
KcE2	Klinesville channery silt loam, 25 to 35 percent slopes, moderately eroded.			
KcE3	Klinesville channery silt loam, 25 to 35 percent slopes, severely eroded.			
KcF	Klinesville channery silt loam, 35 to 80 percent slopes.			
KcF3	Klinesville channery silt loam, 35 to 80 percent slopes, severely eroded.			
KvD	Klinesville very stony silt loam, 8 to 25 percent slopes.			
KvF	Klinesville very stony silt loam, 25 to 80 percent slopes.			
LaB2	Laidig gravelly loam, 3 to 8 percent slopes, moderately eroded.	36+	4–30	Lower slopes. Four feet or more of well-drained gravelly and stony loam to gravelly silty clay loam. Soils have developed on colluvium from mixed red and gray sandstone, shale, and siltstone. Stones and cobbles are throughout profile, and the very stony phases have them on the surface. Some surface boulders are as much as 3 feet in diameter. Very stony phases also have stones resulting from strip mining.
LaC2	Laidig gravelly loam, 8 to 15 percent slopes, moderately eroded.			
LaD3	Laidig gravelly loam, 15 to 25 percent slopes, severely eroded.			
LdB	Laidig very stony loam, 3 to 8 percent slopes.			
LdD	Laidig very stony loam, 8 to 25 percent slopes.			
LeA	Leck Kill channery silt loam, 0 to 3 percent slopes.	36+	1½–3	Upland. One and one-half to 3 feet of well-drained channery silt loam to loam. Soils have developed in glaciated, red siltstone, sandstone, and shale. The very stony phases occur on slopes of higher mountains where red rock outcrops.
LeB2	Leck Kill channery silt loam, 3 to 8 percent slopes, moderately eroded.			
LeC2	Leck Kill channery silt loam, 8 to 15 percent slopes, moderately eroded.			
LeC3	Leck Kill channery silt loam, 8 to 15 percent slopes, severely eroded.			
LeD2	Leck Kill channery silt loam, 15 to 25 percent slopes, moderately eroded.			
LeD3	Leck Kill channery silt loam, 15 to 25 percent slopes, severely eroded.			
LkB	Leck Kill very stony loam, 0 to 8 percent slopes.			
LkD	Leck Kill very stony loam, 8 to 25 percent slopes.			
LkF	Leck Kill very stony loam, 25 to 100 percent slopes.			

See footnotes at end of table.

engineering soil classifications and physical properties—Continued

Depth of layers and estimated engineering soil classifications			Percentage passing sieve—			Estimated properties of soil layers					
									Moisture-density [2]		
From surface	Unified	AASHO	No. 200 (0.074 mm.)	No. 10 (2.0 mm.)	No. 4 (4.7 mm.)	Permeability	Water-holding capacity	pH	Optimum moisture	Maximum dry density	Shrink-swell potential
Inches						*In./hr.*	*Inches*		*Percent*	*Lbs./cu. ft.*	
0–11						2.0 –6.3	2.5	4.8			
11–30	GM–GC, SM–SC.	A–4	42	68	73	0.63–2.0	3.75	5.6	14	120	Low.
30–48	SM–SC	A–4	36	74	78	0.63–2.0	3.75	5.2	12	122	Low.
0–8						0.63–2.0	1.6	6.2			
8–19	ML	A–6	60	75	90	0.2 –0.63	2.5	5.8	15	115	Low.
19–24	ML	A–6	80	85	90	0.2 –0.63	1.5	6.0	15	115	Low.
0–5						2.0 –6.3	1.0	6.1			
5–13	GP–GC	A–2	10	20	31	2.0 –6.3	1.0	5.6	12	122	Low.
13–20	GW–GM	A–1	5	11	16	2.0 –6.3	1.3	5.6	16	116	Low.
0–10						2.0 –6.3	2.3	4.7			
10–27	GM	A–2	30	50	55	0.63–2.0	3.2	5.3	12	120	Low.
27–60	GM	A–2	35	55	60	0.2 –0.63	5.0	5.4	12	120	Low.
0–8						2.0 –6.3	1.5	5.0			
8–24	GM	A–1	17	36	44	0.63–2.0	3.3	5.5	10	124	Low.
24–36	GM	A–1	12	28	35	0.63–2.0	2.5	5.2	12	120	Low.

TABLE 4.—*Descriptions of Carbon County soils and their estimated*

Soil symbol	Soil name	Depth to seasonally high water table	Depth to bedrock	Description of site and soil
		Inches	*Feet*	
LsA	Lickdale and Tughill loams and silt loams, 0 to 3 percent slopes.	0	3–18	Upland depressions. Three feet or more of poorly drained or very poorly drained silt loam or stony loam to loam. Soils have developed in glacial till derived from sandstone, siltstone, and shale. Includes extremely stony and some shallow muck areas.
LtA	Lickdale and Tughill very stony loams, 0 to 8 percent slopes.			
LvB	Lordstown very stony silt loam, 0 to 8 percent slopes.	36+	1½–3	Upland. One and one-half to 3 feet of well-drained stony silt loam to loam. Soils have developed from glaciated, gray sandstone, siltstone, and shale of Wisconsin age. Occur on ridgetops and on steep side slopes, mainly overlying the Pocono formation; stony to very stony.
LvD	Lordstown very stony silt loam, 8 to 25 percent slopes.			
LvF	Lordstown very stony silt loam, 25 to 80 percent slopes.			
Ma	Made land.	(4)	(4)	Land which has been stripped, moved, or deposited so that original soil profile is no longer determined.
MbA	Meckesville channery loam, 0 to 3 percent slopes.	36+	3–25	Upland. Three feet or more of well-drained channery loam and stony loam to gravelly clay loam. Soils have developed on glacial till consisting mainly of reddish sandstone, siltstone, and shale. The very stony phases have a moderate number of boulders on the surface.
MbB2	Meckesville channery loam, 3 to 8 percent slopes, moderately eroded.			
MbC2	Meckesville channery loam, 8 to 15 percent slopes, moderately eroded.			
McB	Meckesville very stony loam, 0 to 8 percent slopes.			
McD	Meckesville very stony loam, 8 to 25 percent slopes.			
MdA	Middlebury silt loam, 0 to 3 percent slopes.	16+	4–10	Along streams. Four feet or more of moderately well drained to somewhat poorly drained silt loam to gravelly clay loam. Soils have developed in alluvium.
MdB	Middlebury silt loam, 3 to 8 percent slopes.			
MeA3	Middlebury and Tioga silt loams, 0 to 3 percent slopes, severely eroded.	18–48	3–10	Along streams. Three feet or more of medium textured or moderately light textured alluvial soil that is subject to frequent flooding. Soils have been severely eroded and gouged by floodwaters.
Mm	Mine dumps.	36+	(4)	Variable. Carbonaceous shale and other mine refuse in piles and mounds.
Mn	Mine dumps, coal.		----------	Fine waste from coalbreakers piled in mounds and ridges.
MoA	Montevallo channery silt loam, 0 to 3 percent slopes.	36+	5–1.5	Upland. Shallow, well-drained soils containing many fragments of gray sandstone and siltstone. Thickness in most places is less than 3 feet to bedrock, which consists of stratified, folded sandstone, siltstone, and shale. Coarse fragments are 10 to 80 percent of soil mass and range in size from 1 inch to 10 inches.
MoB2	Montevallo channery silt loam, 3 to 8 percent slopes, moderately eroded.	36+		
MoB3	Montevallo channery silt loam, 3 to 8 percent slopes, severely eroded.	36+		
MoC2	Montevallo channery silt loam, 8 to 15 percent slopes, moderately eroded.	36+		
MoC3	Montevallo channery silt loam, 8 to 15 percent slopes, severely eroded.	(3)		
MoD2	Montevallo channery silt loam, 15 to 25 percent slopes, moderately eroded.	(3)		
MoD3	Montevallo channery silt loam, 15 to 25 percent slopes, severely eroded.	(3)		
MoE2	Montevallo channery silt loam, 25 to 35 percent slopes, moderately eroded.	(3)		
MoE3	Montevallo channery silt loam, 25 to 35 percent slopes, severely eroded.	(3)		
MoF2	Montevallo channery silt loam, 35 to 100 percent slopes, eroded.	(3)		

See footnotes at end of table.

engineering soil classifications and physical properties—Continued

Depth of layers and estimated engineering soil classifications			Percentage passing sieve—			Estimated properties of soil layers					
From surface	Unified	AASHO	No. 200 (0.074 mm.)	No. 10 (2.0 mm.)	No. 4 (4.7 mm.)	Permeability	Water-holding capacity	pH	Moisture-density [2]		Shrink-swell potential
									Optimum moisture	Maximum dry density	
Inches						*In./hr.*	*Inches*		*Percent*	*Lbs./cu. ft.*	
0–10						2. 0–6. 3	2. 03	5. 5			
10–36	ML	A–4	40	45	50	<0. 2	(4)	5. 5	13	115	Medium.
36–84	ML	A–4	40	45	50	<0. 2	(4)	5. 5	13	115	Medium.
0–6						2. 0–6. 3	1. 2	5. 5			
6–30	GM	A–2	18	35	45	2. 0–6. 3	4. 0	5. 2	12	120	Low.
		(4)	(4)	(4)	(4)		(4)	(4)	(4)	(4)	
0–11						2. 0–6. 3	2. 5	5. 8			
8–36	SM, GM	A–4	42	68	73	0. 63–2. 0	5. 8	6. 0	14	120	Low.
36–60	SM, GM	A–4	36	74	78	0. 63–2. 0	4. 0	5. 2	14	120	Low.
0–11						2. 0–6. 3	2. 5	6. 2			
11–25	ML	A–4	60	70	80	2. 0–6. 3	3. 0	6. 2	16	120	Low.
25–38	GM, SM, ML	A–4	50	60	70	0. 2–0. 63	2. 5	6. 0	16	120	Low.
0–120	GM, SM, ML	A–4	50	60	70	0. 2–0. 63	20. 0	6. 0	16	120	Low.
(4)			(4)	(4)	(4)	>6. 3		(5)			Low.
			25	50	90	>6. 3		(5)			Low.
0–5						2. 0–6. 3	1. 0	5. 5			
5–12	GM	A–1	12	21	24	2. 0–6. 3	1. 0	5. 2	14	116	Low.
12–23	GP	A–2	1	3	6	2. 0–6. 3	2. 0	5. 2	14	116	Low.

TABLE 4.—*Descriptions of Carbon County soils and their estimated*

Soil symbol[1]	Soil name	Depth to seasonally high water table	Depth to bedrock	Description of site and soil
		Inches	*Feet*	
MrB	Morris very stony silt loam, 0 to 8 percent slopes.	0	4–20	Upland. Four feet or more of somewhat poorly drained to poorly drained stony silt loam to stony silty clay loam with fragipan. Soil has developed in glacial till of Wisconsin age derived from mixed red and gray sandstone, siltstone, and shale.
Mu	Muck and Peat.	0	5–50	One and one-half to 30 feet or more of muck and peat over sandy glacial till. Water table is at ground level most of year. Some boulders in till are 4 feet in diameter.
NaB	Natalie very stony loam, 0 to 8 percent slopes.	19+	4–20	Upland. Four feet or more of moderately well drained to somewhat poorly drained stony loam to sandy clay loam with weak fragipan. Soil has developed in pre-Wisconsin glacial till derived from gray sandstone and conglomerate with some boulders. Stones 4 to 12 inches in diameter are in soil; numerous stones are on surface.
NoA NoB NvB	Norwich silt loam, 0 to 3 percent slopes. Norwich silt loam, 3 to 8 percent slopes. Norwich very stony loam, 0 to 8 percent slopes.	0	4–20	Upland. Four feet or more of poorly drained to very poorly drained silt loam to gravelly silty clay loam. Soils have developed in glacial till derived from reddish sandstone, shale, and siltstone. Very stony phase has stones in and on the soil.
Pa	Papakating silty clay loam.	0	4–30	Flood plain. Four feet or more of very poorly drained, alluvial silt loam to silty clay loam. Soil has developed in flood plain deposits, and it is frequently flooded.
PkA	Pekin silt loam, 0 to 3 percent slopes.	16	4–15	Outwash terraces. Four feet or more of moderately well drained to somewhat poorly drained silt loam to silty clay loam. Soil has developed in fine-textured glacial outwash material.
Ra	Riverwash.	0	2–20	Flood plain. Cobbly and stony islands and severely eroded, poorly drained flood plain soils with indistinguishable profiles.[4]
Rc	Riverwash, coal.	----------	3–30	Recent alluvium consisting of 3 feet or more of fine coal, culm, etc.
RsB RsC RsD RsE	Rushtown shaly silt loam, 3 to 8 percent slopes. Rushtown shaly silt loam, 8 to 15 percent slopes. Rushtown shaly silt loam, 15 to 25 percent slopes. Rushtown shaly silt loam, 25 to 35 percent slopes.	90+	3–14	Upland. Three feet or more of well-drained shaly silt loam. Soils have developed in glacial outwash or colluvial material derived from fine shale and chips of siltstone. Not enough fine material for binder.
ShA ShB2 SmB	Shelmadine silt loam, 0 to 3 percent slopes. Shelmadine silt loam, 3 to 8 percent slopes, moderately eroded. Shelmadine very stony silt loam, 0 to 8 percent slopes.	0	3–20	Upland. Three feet or more of poorly drained silt loam and stony silt loam to silty clay loam with a weak hardpan. Soils have developed in pre-Wisconsin till derived from siltstone, shale, and sandstone. The very stony phase is stony to very stony, and it has some boulders as much as 3 feet in diameter.
Sr	Strip mines.	(4)	(4)	Anthracite strippings with very irregular topography. Strippings consist of stones, soil material, coal, etc.

See footnotes at end of table.

engineering soil classifications and physical properties—Continued

Depth of layers and estimated engineering soil classifications			Percentage passing sieve—			Estimated properties of soil layers					
From surface	Unified	AASHO	No. 200 (0.074 mm.)	No. 10 (2.0 mm.)	No. 4 (4.7 mm.)	Permeability	Water-holding capacity	pH	Moisture-density [2]		Shrink-swell potential
									Optimum moisture	Maximum dry density	
Inches						*In./hr.*	*Inches*		*Percent*	*Lbs./cu. ft.*	
0–8						2.0–6.3	1.5	5.5			
8–30	GM	A–2	33	45	55	<0.2	3.0	5.5	15	120	
30–120	GM	A–2	33	45	55	<0.2	13.0	5.5	15	120	
0–120											
120–180											
0–8						0.63–2.0	1.5	4.8			
8–30	GM	A–2	20	40	50	<0.2	4.0	4.8	12	120	Low.
30–120	GM	A–2	20	40	50	0.2–0.63	16.0	4.8	12	120	Low.
0–10						2.0–6.3	2.0	5.5			
10–36	ML, CL	A–6	50	55	60	<0.2	(3)	5.5	13	115	Medium.
36–84	ML, CL	A–6	50	55	60	<0.2	(3)	5.5	13	115	Medium.
0–10						0.2–0.63	(3)	5.5			
10–72	CL	A–6	70	85	90	<0.2	(3)	5.5	13	115	Medium.
0–10						0.63–2.0	2.0	5.5			
10–36	ML, CL	A–4	65	85	90	0.2–0.63	4.0	5.5	13	115	Low.
36–120	ML, CL	A–4	60	80	85	0.2–0.63	14.0	5.5	13	115	Low.
			5	20	50						
			80	85	90	2.0–6.3	(3)	(5)			Low.
0–10						>6.3	.5	5.0			
10–120	GP	A–1	<5	10	50	>6.3	4.5	5.0			Low.
0–10							2.0	5.2			
10–30	ML, CL	A–6	65	75	80	0.2–6.3	4.5	5.2	16	115	Medium.
30–60	ML, CL	A–6	65	75	80	0.2–6.3	6.0	5.2	16	115	Medium.
		(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)

TABLE 4.—*Descriptions of Carbon County soils and their estimated*

Soil symbol [1]	Soil name	Depth to seasonally high water table	Depth to bedrock	Description of site and soil
		Inches	*Feet*	
SsB	Swartswood channery silt loam, 0 to 8 percent slopes.	36+	3. 5–20	Upland. Three and one-half feet or more of well-drained channery silt loam and stony silt loam to light silty clay loam with hardpan. Soils have developed in Wisconsin glacial till from gray sandstone, siltstone, and shale. Very stony phases are stony to very stony on the surface. All soils have numerous stones throughout the profile.
SsC2	Swartswood channery silt loam, 8 to 15 percent slopes, moderately eroded.			
SwB	Swartswood very stony loam, 0 to 8 percent slopes.			
SwD	Swartswood very stony loam, 8 to 25 percent slopes.			
Tf	Tioga fine sandy loam.	36+	4–20	Flood plains of larger streams. More than 4 feet of sandy or gravelly sand alluvial deposits. Soil is well drained but subject to occasional overflow, deposition, and erosion.
Tg	Tioga silt loam.	36+	4–20	Flood plains. More than 4 feet of medium-textured alluvial deposits. Soil is well drained but subject to overflow, deposition, and erosion.
TmB	Tioga and Middlebury very stony loams, 0 to 8 percent slopes.	18–48	3–10	Narrow valleys along streams. More than 3 feet of stony and cobbly alluvial deposits. Soils are subject to overflow. Drainage varies from good to somewhat poor. Stones vary from cobbles to boulders 3 feet in diameter.
TuA	Tunkhannock gravelly loam, 0 to 3 percent slopes.	36+	5–100+	Outwash and terminal moraines. Fifteen to 30 feet of well-drained, stratified sand and gravel of the Wisconsin glaciation.
TuB	Tunkhannock gravelly loam, 3 to 8 percent slopes.			
TuC	Tunkhannock gravelly loam, 8 to 15 percent slopes.			
TuD	Tunkhannock gravelly loam, 15 to 25 percent slopes.			
VeB	Very stony land, 0 to 8 percent slopes.	----------	0–20	Boulder fields, rockslides, and exposed bedrock without distinct profiles. Boulders are as much as 10 feet in diameter. Areas are too stony to support more than scattered vegetation.
VeD	Very stony land, 8 to 25 percent slopes.			
VeF	Very stony land, 25 to 120 percent slopes.			
VoB	Volusia silt loam, 0 to 8 percent slopes.	0	3–20	Gentle slopes. Poorly drained, medium-textured surface layer over hard, dense pan at a depth of 12 to 36 inches. Firm, dense, gray Wisconsin glacial till extends from a depth of 36 inches to bedrock. Very stony phase has numerous boulders as much as 4 feet in diameter.
VsB	Volusia very stony loam, 0 to 8 percent slopes.			
WaB2	Watson gravelly silt loam, 0 to 8 percent slopes, moderately eroded.	24	4–12	Four feet or more of moderately well drained silt loam. Soils have developed from compact, pre-Wisconsin glacial till derived from siltstone and shale containing some sandstone. Pebbles of quartzite and shale are throughout the profile.
WsA	Watson silt loam, 0 to 3 percent slopes.			
WsB2	Watson silt loam, 3 to 8 percent slopes, moderately eroded.			
WsC2	Watson silt loam, 8 to 15 percent slopes, moderately eroded.			
WtC3	Watson silty clay loam, 8 to 15 percent slopes, severely eroded.			
WuA	Wurtsboro channery loam, 0 to 3 percent slopes.	18	4–20	Moderately well drained, medium-textured surface layer over dense, platy pan at a depth of 18 to 26 inches. Compact, gray and brown Wisconsin glacial till extends from a depth of 26 inches to an average depth of 12 feet.
WuB2	Wurtsboro channery loam, 3 to 8 percent slopes, moderately eroded.			
WvB	Wurtsboro very stony loam, 0 to 8 percent slopes.			
WvD	Wurtsboro very stony loam, 8 to 25 percent slopes.			

[1] The soil symbol identifies the soil on the detailed map in the back of the report.

[2] Estimates are based on AASHO designation T 99–57, Method A, in which only the material passing No. 4 sieve is considered. For total material, the optimum moisture will be lower and the maximum dry density higher than these estimated values.

engineering soil classifications and physical properties—Continued

Depth of layers and estimated engineering soil classifications			Percentage passing sieve—			Estimated properties of soil layers					
									Moisture-density [2]		
From surface	Unified	AASHO	No. 200 (0.074 mm.)	No. 10 (2.0 mm.)	No. 4 (4.7 mm.)	Permeability	Water-holding capacity	pH	Optimum moisture	Maximum dry density	Shrink-swell potential
Inches						*In./hr.*	*Inches*		*Percent*	*Lbs./cu. ft.*	
0–10						2.0 –6.3	1.5	5.0			
10–36	ML, CL	A–4	40	50	65	2.0 –6.3	4.0	5.0	15	115	Low.
36–96	ML, CL	A–4	40	50	65	0.63–2.0	6.0	5.0	15	115	Low.
0–12						2.0 –6.3	2.0	5.2			
12–36	SM, SC	A–2	30	85	90	0.63–2.0	4.0	5.2	12	120	Low.
36–96	SM, SC	A–2	30	85	90	0.63–2.0	9.0	5.2	12	120	Low.
0–18		A–4	70	80	95	2.0 –6.3	4.0	6.2			
18–30	ML	A–4	60	75	90	2.0 –6.3	2.5	6.3	14	120	Low.
30 36	SP–SM	A–1	10	40	85	2.0 –6.3	1.5	6.1	14	120	Low.
0–12						2.0 –6.3	2.0	5.2			
12–36	ML	A–4	50	70	80	0.63–2.0	4.0	5.2	14	120	Low.
36–96	ML, SC, GM	A–4	50	70	80	0.63–2.0	10.0	5.2	14	120	Low.
0–18						2.0 –6.3	1.5	5.0			
18–180	SM	A–2	20	80	85	>6.2	7.0	5.0	13	120	Low.
0–36+			<5	<15	<25	>6.2					
0–8						2.0 –6.3	1.5	5.0			Medium.
8–30	GM	A–2	30	40	45	<0.2	3.0	5.0	15	120	Low.
30–120	GM	A–2	30	40	45	<0.2	13.0	5.0	15	120	Low.
0–8						0.63–2.0	1.5	6.6			
8–40	ML–CL	A–4	64	85	90	0.2 –0.63	5.6	6.0	13	115	Low.
40–53	ML–CL	A–4	59	78	82	0.2 –0.63	2.25	5.2	14	115	Low
0–8						0.63–2.0	1.5	5.0			
8–36	GM, GC	A–2	25	40	45	0.2 –0.63	3.0	5.0	16	115	Low.
36–96	GM, GC	A–2	25	40	45	0.2 0.63	10.0	5.0	16	115	Low.

[3] Free water.
[4] Variable.
[5] Less than 4.5.
[6] Generally very deep.

TABLE 5.—*Suitability and characteristics*

[Absence of data indicates the soil generally has no

Map symbol	Soil series	Suitability for winter grading	Susceptibility to frost action	Suitability of material for—		Suitability as source of—		Characteristics	
				Road subgrade	Road fill	Topsoil [1]	Sand and gravel	Vertical alinement of highways	
								Material	Drainage
AaA, AaB2, AbA, AbB2, AcB, AcD.	Albrights	Fair	High	Fair	Good; poor for clay substratum.	Fair	Unsuitable.	Hardpan; stoniness; clay substratum.	Seasonal high water table.
AdA, AdB2, AdC2, AgA, AgB2, AgC2, AgD2, AmC3, AmD3.	Allenwood	Fair to good.	Moderate to low.	Good	Good	Good	Unsuitable.		
AnB, ArB	Alvira	Unsuitable.	High	Poor	Fair	Poor	Unsuitable.	Hardpan; very stony in places.	Seasonal high water table.
AsA, AsB2, AtB	Alvira and Shelmadine.	Unsuitable.	High	Poor	Fair	Fair	Unsuitable.	Instability.	High water table.
AvA	Andover	Unsuitable.	High	Poor	Fair	Poor	Unsuitable.	Instability.	High water table; seeps.
BcB2, BhB, BhD	Buchanan	Poor	Moderate to high.	Poor	Good	Fair	Unsuitable without crushing.	Hardpan	Seasonal high water table.
CmA, CmB2, CmC, CnC3, CoB, CoD.	Comly	Fair to poor.	High	Fair	Fair	Fair	Unsuitable.	Claypan; outcrops.	Seasonal high water table.
CtA, CtB, CtD	Conotton	Good	Low	Good	Good	Fair	Good		
DeB, DeD, DeF	Dekalb	Good	Low except for seeps.	Good	Good	Poor	Unsuitable without crushing.	Stoniness; slopes; outcrops.	Occasional seeps.
DrA, DrB2, DsB	Drifton	Fair	Moderate to high.	Fair	Good	Fair	Unsuitable.	Hardpan	Seasonal high water table.
FtA, FtB2, FtC2, FvB, FvD, FvF, FwB, FwD.	Fleetwood	Good	Low	Good	Good	Poor	Unsuitable without crushing.	Stoniness; slopes.	
HaA, HaB2, HaC2, HaC3, HaD2, HaD3, HsB, HsD.	Hartleton	Good	Low	Good	Good	Fair	Unsuitable.		
HtA, HtB, HtB2, HtC2, HvB, HvD.	Hazleton	Good	Low	Good	Good	Good	Unsuitable.		
Hy	Holly	Unsuitable.	High	Poor	Poor	Good	Unsuitable.	Instability; organic matter.	Flooding; high water table.

See footnote at end of table.

of Carbon County soils for engineering construction

special characteristics that interfere with the stated use]

that affect—		Characteristics that affect suitability for—							
Construction and maintenance of pipelines	Infiltration of septic tank effluent.	Dikes and levees	Farm ponds		Terraces and diversions	Waterways	Building sites	Agricultural drainage	Irrigation
			Reservoir area	Embankment					
Fluctuating water table.	Seasonal high water table.				Hardpan below usual channel depth.	Seasonal high water table.	Seasonal high water table.	Hardpan	Hardpan.
Fluctuating water table.	Shallowness; seasonal high water table.				Shallow hardpan.	Shallow waterways.	Shallowness; seasonal high water table.	Hardpan	Shallowness to pan.
High water table.	High water table.	Instability		Instability		Shallowness to pan.	High water table.	Slow permeability.	Shallowness to pan.
High water table.	High water table.	Instability		Instability	Shallowness to pan; stoniness.	Shallowness to pan; stoniness.	High water table.	Shallowness to pan; stoniness.	Shallowness to pan; stoniness.
Fluctuating water table.	Variable depth to hardpan.	Stoniness	Permeability.	Occasional boulders.	Variable depth to hardpan.	Variable depth to hardpan.	Variable depth to hardpan.	Variable depth to hardpan.	Variable depth to hardpan.
Fluctuating water table.	Seasonal high water table.	Good	Permeability.		Hardpan below usual channel depth.		Seasonal high water table.	Claypan	Shallowness to pan.
		Permeability.	Permeability.	Permeability.	Erodibility.	Erodibility.			Low water-holding capacity.
Shallowness; stoniness.	Shallowness.	Stoniness	Shallowness; permeability.	Stoniness	Stoniness; shallowness.	Shallowness; stoniness.	Shallowness.		Shallowness.
Fluctuating water table.	Seasonal high water table.				Hardpan below usual channel depth.	Hardpan	Seasonal high water table.	Hardpan	Hardpan.
Stoniness; some boulders.		Stoniness	Shallowness; permeability.	Stoniness	Stoniness	Stoniness			
			Permeability.	Occasional shallowness.					
		Accessibility.	Permeability.						
Poor drainage.	High water table; flooding.	Instability.		Instability.	Flooding; lack of outlets.	Flooding; lack of outlets.	High water table; flooding.	Flooding	Wetness.

TABLE 5.—*Suitability and characteristics*

Map symbol	Soil series	Suitability for winter grading	Susceptibility to frost action	Suitability of material for—		Suitability as source of—		Characteristics	
				Road subgrade	Road fill	Topsoil [1]	Sand and gravel	Vertical alinement of highways	
								Material	Drainage
KcB2, KcC2, KcC3, KcD2, KcD3, KcE2, KcE3, KcF, KcF3, KvD, KvF.	Klinesville	Good	Low	Good	Good	Poor	Unsuitable.	Stoniness; steepness; outcrops.	
LaB2, LaC2, LaD3, LdB, LdD.	Laidig	Fair	Moderate to low.	Good	Good	Fair	Unsuitable without crushing.	Hardpan; stoniness.	
LeA, LeB2, LeC2, LeC3, LeD2, LeD3, LkB, LkD, LkF.	Leck Kill	Good	Low	Good	Good	Poor	Unsuitable.	Stoniness; outcrops.	
LsA, LtA	Lickdale and Tughill.	Unsuitable.	High	Poor; muck unsuitable.	Poor; muck unsuitable.	Poor	Unsuitable.	Instability; mucky surface layer.	High water table.
LvB, LvD, LvF	Lordstown	Good	Low except for seeps.	Good	Good	Poor	Unsuitable without crushing.	Stoniness; slopes; outcrops.	Occasional seeps.
Ma	Made land	Variable	Variable	Variable	Variable	Unsuitable.	Unsuitable.	Variable	Variable
MbA, MbB2, MbC2, McB McD.	Meckesville	Good	Moderate to low.	Good	Good	Good	Unsuitable.		
MdA, MdB	Middlebury	Poor	High	Fair	Good	Good	Fair for sand.		Flooding; high water table.
MeA3	Middlebury and Tioga.	Poor to fair.	High	Fair	Good	Unsuitable.	Fair for sand.		Flooding; high water table.
Mm	Mine dumps.	Fair	Moderate	Fair	Fair	Unsuitable.	Unsuitable.	Coal and soft shale.	
Mn	Mine dumps, coal.	Unsuitable.	Moderate	Unsuitable.	Unsuitable.	Unsuitable.	Unsuitable.	Unsuitable.	
MoA, MoB2, MoB3, MoC2, MoC3, MoD2, MoD3, MoE2, MoE3, MoF2.	Montevallo	Good	Low	Good	Good	Fair	Unsuitable.	Outcrops; stoniness.	
MrB	Morris	Unsuitable.	High	Poor	Fair	Fair	Unsuitable.	Claypan	High water table.
Mu	Muck and Peat.	Unsuitable.	High	Unsuitable.	Unsuitable.	Fair	Unsuitable.	Muck and peat.	Flooding
NaB	Natalie	Fair	Low to moderate.	Poor	Fair	Poor	Unsuitable unless crushed.	Hardpan; stoniness.	High water table.
NoA, NoB, NvB	Norwich	Unsuitable.	High	Poor	Poor	Poor	Unsuitable.	Instability.	High water table.

See footnote at end of table.

of Carbon County soils for engineering construction—Continued

that affect—		Characteristics that affect suitability for—							
Construction and maintenance of pipelines	Infiltration of septic tank effluent	Dikes and levees	Farm ponds		Terraces and diversions	Waterways	Building sites	Agricultural drainage	Irrigation
			Reservoir area	Embankment					
Stoniness; shallowness.	Shallowness.	Permeability; shallowness.	Shallowness; permeability.	Shallowness; permeability.	Permeability; shallowness.	Shallowness.	----------	----------	Shallowness.
Occasional boulders.	----------	Stoniness--	Permeability.	Occasional boulders.	Occasional boulders.	Occasional boulders.	----------	Hardpan below 3 feet.	
Stoniness; shallowness.	Stoniness---	Permeability; shallowness.	Permeability; shallowness.	Shallowness; permeability.	----------	----------	----------	----------	
High water table.	High water table.	Instability.	----------	Instability.	Stoniness; lack of outlets.	Lack of outlets.	High water table.	Stoniness---	
Shallowness; stoniness.	Shallowness.	Stoniness--	Shallowness; permeability.	Stoniness--	Stoniness; shallowness.	Shallowness; stoniness.	Shallowness.	----------	Shallowness.
Variable---	Variable----	Variable---	Variable---	Variable---	Variable----	Variable----	Variable ---	Variable----	Variable.
----------	----------	---------	Permeability.	----------	----------	----------	----------	----------	
Flooding---	Flooding; high water table.	Permeability.	Permeability.	----------	Lack of outlets; flooding.	Lack of outlets.	Flooding---	----------	
Flooding---	Flooding; high water table.	Permeability.	Permeability.	---- ----	Lack of outlets; flooding.	Lack of outlets.	Flooding---	----------	
Extreme acidity.	Instability..	Permeability.	Permeability.	Permeability.	----------	----------	Instability--	----------	
Instability; extremely high acidity.	----------	Unsuitable.	Unsuitable.	Unsuitable.	----------	------- ----	Instability--	----------	Shallowness.
Shallowness; stoniness.	Shallowness.	Shallowness.	Shallowness; permeability.	Shallowness.	Shallowness; permeability.	Shallowness.	Shallowness.	----------	
Fluctuating water table.	High water table.	----------	----------	----------	----------	Shallowness to pan.	High water table.	Occasional boulders.	Shallowness to pan.
Instability	High water table.	Instability.	Organic material.	Instability.	Lack of outlets.	Lack of outlets; instability.	Flooding---	Lack of outlets; instability.	
High water table.	High water table.	Stoniness--	Stoniness--	----------	Stoniness---	Stoniness---	High water table.	Stoniness---	Shallowness to pan; stoniness.
High water table.	High water table.	Instability.	----------	Instability.	Lack of outlets.	Lack of outlets.	High water table.	Lack of outlets.	

TABLE 5.—*Suitability and characteristics of Carbon*

Map symbol	Soil series	Suitability for winter grading	Susceptibility to frost action	Suitability of material for—		Suitability as source of—		Characteristics	
				Road subgrade	Road fill	Topsoil [1]	Sand and gravel	Vertical alinement of highways	
								Material	Drainage
Pa	Papakating	Unsuitable.	High	Poor	Poor	Fair	Unsuitable.	Instability	Flooding
PkA	Pekin	Poor	High	Fair	Good	Fair	Unsuitable.	Siltiness; highly erodible on cut slopes.	Seasonal high water table.
Ra	Riverwash	Unsuitable.	Variable	Unsuitable.	Fair	Unsuitable.	Unsuitable without crushing.	Stoniness	Flooding
Rc	Riverwash, coal.	Unsuitable.	High	Poor	Poor	Unsuitable.	Unsuitable.	Unsuitable.	Flooding
RsB, RsC, RsD, RsE.	Rushtown	Good	Low	Good	Good	Fair	Good source of soft shale.		
ShA, ShB2, SmB	Shelmadine	Unsuitable.	High	Poor	Poor	Poor	Unsuitable.	Instability	High water table.
Sr	Strip mines	Good	Moderate	Fair	Good	Unsuitable.	Unsuitable.	Variable	
SsB, SsC2, SwB, SwD.	Swartswood.	Fair to poor.	Moderate to high.	Good	Good	Fair	Poor	Hardpan; stoniness.	
Tf, Tg	Tioga	Poor	Moderate to high.	Good to fair.	Good to fair.	Good	Variable		Flooding
TmB	Tioga and Middlebury.	Fair to poor.	Moderate to high.	Fair	Good	Good	Variable		Flooding
TuA, TuB, TuC, TuD.	Tunkhannock.	Good	Low	Good	Good	Fair	Good		
VeB, VeD, VeF	Very stony land.	Good	Low	Poor without binder.	Poor without binder.	Unsuitable.	Unsuitable without crushing.	Bedrock; very stony; steep.	
VoB, VsB	Volusia	Unsuitable.	High	Poor	Fair	Poor	Unsuitable.	Instability	High water table.
WaB2, WsA, WsB2, WsC2, WtC3.	Watson	Poor to unsuitable.	High	Fair	Fair	Fair	Unsuitable.	Hardpan; stoniness.	
WuA, WuB2, WvB, WvD.	Wurtsboro	Fair	Moderate	Fair	Good	Fair	Unsuitable.	Weak pan	Seasonal high water table.

[1] Rating applies only to the natural soil surface layer.

County soils for engineering construction—Continued

that affect—		Characteristics that affect suitability for—							
Construction and maintenance of pipelines	Infiltration of septic tank effluent	Dikes and levees	Farm ponds		Terraces and diversions	Waterways	Building sites	Agricultural drainage	Irrigation
			Reservoir area	Embankment					
Flooding	High water table.	Instability		Instability	Lack of outlets.	Lack of outlets.	Flooding	Lack of outlets.	
Fluctuating water table.	Seasonal high water table.				Hardpan below normal channel depth.	Weak pan	Seasonal high water table.	Slow permeability.	
Stoniness; shifting bedload.	Frequent flooding.	Permeability.	Overflow with swift current.	Permeability and stoniness.			Frequent flooding.		
Instability; extremely high acidity.	Flooding; seasonal high water table.	Unsuitable.	Unsuitable.	Unsuitable.			Flooding; instability.		
		Permeability.	Permeability.	Permeability.	Permeability; instability.	Permeability.			Low moisture-holding capacity.
High water table.	High water table.								
Variable; instability in some places.	Variable	Variable		Stoniness		Variable	Variable		
			Permeability.						
Flooding	Flooding	Permeability.	Permeability.		Lack of outlets and flooding.	Outlets	Flooding		
Flooding	Flooding; high water table.	Permeability.	Permeability.		Lack of outlets and flooding.	Outlets	Flooding		
		Permeability.	Permeability.	Permeability.	Erodibility	Erodibility			Low water-holding capacity.
Shallowness.	Stoniness	Stoniness	Stoniness	Stoniness	Stoniness	Stoniness	Stoniness		Stoniness.
Fluctuating water table.	High water table.	Instability		Instability		Shallowness to hardpan.	High water table.	Shallowness to hardpan.	Shallowness to hardpan.
Fluctuating water table.	Seasonal high water table.				Pan below usual channel depth.	Weak pan	Seasonal high water table.	Weak pan	Weak pan.
Fluctuating water table.	Seasonal high water table.		Permeability below hardpan.		Pan below usual channel depth.	Weak pan	Seasonal high water table.	Weak pan	Weak pan.

Descriptions of the Soils

All the soils mapped in Carbon County are described in this section. First the soil series are described and then, more briefly, the individual soils, or mapping units. A soil series is a group of soils that have developed from similar parent material and that have similar characteristics, except for the texture of the surface layer. The descriptions of the soil series tell about the general characteristics of the soils in the series and their relation to the soils of other series. A representative soil profile is described for each series. A soil profile is a vertical section showing all layers, or horizons, from the surface through the parent material.

The mapping units in a given series have essentially the same characteristics, except for the texture of the surface layer and external properties. The external properties, such as slope, erosion, and deposition of new material, particularly affect management of the soils but do not affect their placement in an orderly natural classification. Hence, only a few sentences are given to point out distinctive characteristics of some of the mapping units that follow the series description.

Following the name of each soil, there is a set of symbols in parentheses. These identify the soil on the detailed map in the back of the report. The first two letters (a capital letter and a small letter) identify the soil series; the second capital letter, the steepness of slope; and the Arabic number shows the degree of erosion. The names of most of the soils also describe the slope and the degree of erosion.

The descriptions of the soils and the soil series are somewhat technical. To help the reader, a few of the commonly used terms are defined in the Glossary and are discussed in the following paragraphs.

In describing the soils, the scientist frequently assigns a letter symbol, for example, "A_1," to the various layers. These symbols have special meanings that concern scientists and others who desire to make a special study of the soils. Most readers will need to remember only that all letter symbols beginning with "A" are surface soil and subsurface soil; those beginning with "B" are subsoil; those beginning with "C" are substratum, or parent material; and those beginning with "D" are underlying, dissimilar material. All measurements refer to depth from the surface.

Color is denoted in two ways, by a descriptive term and by a Munsell notation. The descriptive term, for example, "reddish brown," is followed by a Munsell notation, such as "(5YR 4/4)." Munsell notations denote the color with a great deal more precision than is possible through the use of words. Unless otherwise stated, the color given is the color of the soil material when moist.

The texture of the soil refers to the content of sand, silt, and clay. It is determined by the way the soil feels when rubbed between the fingers, and it is checked by laboratory analyses. Each mapping unit is identified by a textural class name, such as fine sandy loam. This refers to the texture of the surface layer, or A horizon.

The structure is indicated by the way the individual soil particles are arranged in larger grains, or aggregates, and the amount of pore space between grains. The structure of the soil is determined by the strength or grade, the size, and the shape of the aggregates. For example, a horizon may have "weak, fine, blocky structure." Other terms used in describing soils are defined in the Glossary.

A list of the soils and the map symbol, capability unit, and woodland suitability group of each are given in the "Guide to Mapping Units, Capability Units, and Woodland Suitability Groups" at the end of the report. The location and distribution of the mapping units are shown on the detailed soil map in the back of the report. The approximate acreage and proportionate extent of the mapping units are given in table 6.

TABLE 6.—*Approximate acreage and proportionate extent of the soils mapped in Carbon County, Pa.*

Soil	Area	Extent	Soil	Area	Extent
	Acres	*Percent*		*Acres*	*Percent*
Albrights channery loam, 0 to 3 percent slopes	36	(1)	Allenwood gravelly silty clay loam, 15 to 25 percent slopes, severely eroded	47	(1)
Albrights channery loam, 3 to 8 percent slopes, moderately eroded	746	0.3	Alvira gravelly silt loam, 0 to 8 percent slopes	539	0.2
Albrights silt loam, 0 to 3 percent slopes	48	(1)	Alvira very stony silt loam, 0 to 8 percent slopes	2,096	.8
Albrights silt loam, 3 to 8 percent slopes, moderately eroded	2,008	.8	Alvira and Shelmadine silt loams, 0 to 3 percent slopes	1,219	.5
Albrights very stony loam, 0 to 8 percent slopes	6,335	2.4	Alvira and Shelmadine silt loams, 3 to 8 percent slopes, moderately eroded	225	.1
Albrights very stony loam, 8 to 25 percent slopes	980	.4	Alvira and Shelmadine very stony silt loams, 0 to 8 percent slopes	1,556	.6
Allenwood gravelly loam and silt loam, 0 to 3 percent slopes	478	.2	Andover very stony loam, 0 to 3 percent slopes	637	.2
Allenwood gravelly loam and silt loam, 3 to 8 percent slopes, moderately eroded	2,084	.8	Buchanan gravelly loam, 3 to 10 percent slopes, moderately eroded	789	.3
Allenwood gravelly loam and silt loam, 8 to 15 percent slopes, moderately eroded	173	.1	Buchanan very stony loam, 0 to 8 percent slopes	4,261	1.6
Allenwood gravelly silt loam, 0 to 3 percent slopes	615	.2	Buchanan very stony loam, 8 to 25 percent slopes	2,206	.9
Allenwood gravelly silt loam, 3 to 8 percent slopes, moderately eroded	3,170	1.2	Comly silt loam, 0 to 3 percent slopes	291	.1
Allenwood gravelly silt loam, 8 to 15 percent slopes, moderately eroded	470	.2	Comly silt loam, 3 to 8 percent slopes, moderately eroded	1,057	.4
Allenwood gravelly silt loam, 15 to 25 percent slopes, moderately eroded	14	(1)	Comly silt loam, 8 to 15 percent slopes	37	(1)
Allenwood gravelly silty clay loam, 8 to 15 percent slopes, severely eroded	258	.1	Comly silty clay loam, 8 to 15 percent slopes, severely eroded	202	.1
			Comly very stony silt loam, 0 to 8 percent slopes	382	.1

See footnote at end of table.

TABLE 6.—*Approximate acreage and proportionate extent of the soils mapped in Carbon County, Pa.*—Continued

Soil	Area	Extent
	Acres	*Percent*
Comly very stony silt loam, 8 to 25 percent slopes	159	0.1
Conotton gravelly loam, 0 to 3 percent slopes	387	.1
Conotton gravelly loam, 3 to 8 percent slopes	59	(1)
Conotton gravelly loam, 15 to 25 percent slopes	28	(1)
Dekalb very stony loam, 0 to 8 percent slopes	2,382	.9
Dekalb very stony loam, 8 to 25 percent slopes	10,714	4.1
Dekalb very stony loam, 25 to 100 percent slopes	13,400	5.2
Drifton loam, 0 to 3 percent slopes	1,703	.7
Drifton loam, 3 to 8 percent slopes, moderately eroded	315	.1
Drifton very stony loam, 0 to 8 percent slopes	4,841	1.9
Fleetwood sandy loam, 0 to 3 percent slopes	177	.1
Fleetwood sandy loam, 3 to 8 percent slopes, moderately eroded	203	.1
Fleetwood sandy loam, 8 to 15 percent slopes, moderately eroded	315	.1
Fleetwood very stony loam, shallow, 0 to 8 percent slopes	658	.3
Fleetwood very stony loam, shallow, 8 to 25 percent slopes	2,191	.8
Fleetwood very stony loam, shallow, 25 to 100 percent slopes	1,878	.7
Fleetwood very stony sandy loam, 0 to 8 percent slopes	732	.3
Fleetwood very stony sandy loam, 8 to 25 percent slopes	1,111	.4
Hartleton channery silt loam, 0 to 3 percent slopes	314	.1
Hartleton channery silt loam, 3 to 8 percent slopes, moderately eroded	3,597	1.4
Hartleton channery silt loam, 8 to 15 percent slopes, moderately eroded	753	.3
Hartleton channery silt loam, 8 to 15 percent slopes, severely eroded	786	.3
Hartleton channery silt loam, 15 to 25 percent slopes, moderately eroded	63	(1)
Hartleton channery silt loam, 15 to 25 percent slopes, severely eroded	155	.1
Hartleton very stony loam, 0 to 8 percent slopes	203	.1
Hartleton very stony loam, 8 to 25 percent slopes	234	.1
Hazleton loam, 0 to 3 percent slopes	1,583	.6
Hazleton loam, 3 to 8 percent slopes	1,569	.6
Hazleton loam, 3 to 8 percent slopes, moderately eroded	817	.3
Hazleton loam, 8 to 15 percent slopes, moderately eroded	400	.2
Hazleton very stony loam, 0 to 8 percent slopes	14,364	5.5
Hazleton very stony loam, 8 to 25 percent slopes	6,614	2.6
Holly silt loam	4,427	1.7
Klinesville channery silt loam, 3 to 8 percent slopes, moderately eroded	1,781	.7
Klinesville channery silt loam, 8 to 15 percent slopes, moderately eroded	1,839	.7
Klinesville channery silt loam, 8 to 15 percent slopes, severely eroded	1,049	.4
Klinesville channery silt loam, 15 to 25 percent slopes, moderately eroded	1,113	.4
Klinesville channery silt loam, 15 to 25 percent slopes, severely eroded	1,370	.5
Klinesville channery silt loam, 25 to 35 percent slopes, moderately eroded	1,030	.4
Klinesville channery silt loam, 25 to 35 percent slopes, severely eroded	1,123	.4
Klinesville channery silt loam, 35 to 80 percent slopes	849	.3
Klinesville channery silt loam, 35 to 80 percent slopes, severely eroded	127	(1)
Klinesville very stony silt loam, 8 to 25 percent slopes	244	0.1
Klinesville very stony loam, 25 to 80 percent slopes	5,444	2.1
Laidig gravelly loam, 3 to 8 percent slopes, moderately eroded	526	.2
Laidig gravelly loam, 8 to 15 percent slopes, moderately eroded	1,113	.4
Laidig gravelly loam, 15 to 25 percent slopes, severely eroded	176	.1
Laidig very stony loam, 3 to 8 percent slopes	2,001	.8
Laidig very stony loam, 8 to 25 percent slopes	6,181	2.4
Leck Kill channery silt loam, 0 to 3 percent slopes	229	.1
Leck Kill channery silt loam, 3 to 8 percent slopes, moderately eroded	3,060	1.2
Leck Kill channery silt loam, 8 to 15 percent slopes, moderately eroded	2,301	.9
Leck Kill channery silt loam, 8 to 15 percent slopes, severely eroded	693	.3
Leck Kill channery silt loam, 15 to 25 percent slopes, moderately eroded	354	.1
Leck Kill channery silt loam, 15 to 25 percent slopes, severely eroded	508	.2
Leck Kill very stony loam, 0 to 8 percent slopes	1,697	.7
Leck Kill very stony loam, 8 to 25 percent slopes	7,438	2.9
Leck Kill very stony loam, 25 to 100 percent slopes	1,680	.6
Lickdale and Tughill loams and silt loams, 0 to 3 percent slopes	132	.1
Lickdale and Tughill very stony loams, 0 to 8 percent slopes	1,818	.7
Lordstown very stony silt loam, 0 to 8 percent slopes	877	.3
Lordstown very stony silt loam, 8 to 25 percent slopes	1,952	.8
Lordstown very stony silt loam, 25 to 80 percent slopes	402	.2
Made land	1,786	.7
Meckesville channery loam, 0 to 3 percent slopes	300	.1
Meckesville channery loam, 3 to 8 percent slopes, moderately eroded	3,502	1.4
Meckesville channery loam, 8 to 15 percent slopes, moderately eroded	957	.4
Meckesville very stony loam, 0 to 8 percent slopes	9,914	3.8
Meckesville very stony loam, 8 to 25 percent slopes	4,810	1.9
Middlebury silt loam, 0 to 3 percent slopes	1,672	.6
Middlebury silt loam, 3 to 8 percent slopes	1,190	.5
Middlebury and Tioga silt loams, 0 to 3 percent slopes, severely eroded	301	.1
Mine dumps	908	.4
Mine dumps, coal	422	.2
Montevallo channery silt loam, 0 to 3 percent slopes	174	.1
Montevallo channery silt loam, 3 to 8 percent slopes, moderately eroded	7,317	2.8
Montevallo channery silt loam, 3 to 8 percent slopes, severely eroded	3	(1)
Montevallo channery silt loam, 8 to 15 percent slopes, moderately eroded	7,982	3.1
Montevallo channery silt loam, 8 to 15 percent slopes, severely eroded	86	(1)
Montevallo channery silt loam, 15 to 25 percent slopes, moderately eroded	6,263	2.4
Montevallo channery silt loam, 15 to 25 percent slopes, severely eroded	156	.1
Montevallo channery silt loam, 25 to 35 percent slopes, moderately eroded	4,180	1.6

See footnote at end of table.

TABLE 6.—*Approximate acreage and proportionate extent of the soils mapped in Carbon County, Pa.*—Continued

Soil	Area	Extent
	Acres	*Percent*
Montevallo channery silt loam, 25 to 35 percent slopes, severely eroded	519	0. 2
Montevallo channery silt loam, 35 to 100 percent slopes, eroded	2, 598	1. 0
Morris very stony silt loam, 0 to 8 percent slopes	1, 574	. 6
Muck and Peat	863	. 3
Natalie very stony loam, 0 to 8 percent slopes	708	. 3
Norwich silt loam, 0 to 3 percent slopes	47	(1)
Norwich silt loam, 3 to 8 percent slopes	2	(1)
Norwich very stony loam, 0 to 8 percent slopes	702	. 3
Papakating silty clay loam	913	. 4
Pekin silt loam, 0 to 3 percent slopes	36	(1)
Riverwash	112	(1)
Riverwash, coal	482	. 2
Rushtown shaly silt loam, 3 to 8 percent slopes	2	(1)
Rushtown shaly silt loam, 8 to 15 percent slopes	8	(1)
Rushtown shaly silt loam, 15 to 25 percent slopes	2	(1)
Rushtown shaly silt loam, 25 to 35 percent slopes	11	(1)
Shelmadine silt loam, 0 to 3 percent slopes	1, 035	. 4
Shelmadine silt loam, 3 to 8 percent slopes, moderately eroded	301	. 1
Shelmadine very stony silt loam, 0 to 8 percent slopes	3, 350	1. 3
Strip mines	4, 579	1. 8
Swartswood channery silt loam, 0 to 8 percent slopes	114	(1)
Swartswood channery silt loam, 8 to 15 percent slopes, moderately eroded	13	(1)
Swartswood very stony loam, 0 to 8 percent slopes	2, 466	1. 0
Swartswood very stony loam, 8 to 25 percent slopes	1, 172	. 5
Tioga fine sandy loam	518	. 2
Tioga silt loam	177	0. 1
Tioga and Middlebury very stony loams, 0 to 8 percent slopes	1, 931	. 7
Tunkhannock gravelly loam, 0 to 3 percent slopes	50	(1)
Tunkhannock gravelly loam, 3 to 8 percent slopes	1, 920	. 7
Tunkhannock gravelly loam, 8 to 15 percent slopes	1, 589	. 6
Tunkhannock gravelly loam, 15 to 25 percent slopes	1, 939	. 7
Very stony land, 0 to 8 percent slopes	203	. 1
Very stony land, 8 to 25 percent slopes	485	. 2
Very stony land, 25 to 120 percent slopes	7, 998	3. 1
Volusia silt loam, 0 to 8 percent slopes	39	(1)
Volusia very stony loam, 0 to 8 percent slopes	1, 327	. 5
Watson gravelly silt loam, 0 to 8 percent slopes, moderately eroded	574	. 2
Watson silt loam, 0 to 3 percent slopes	933	. 4
Watson silt loam, 3 to 8 percent slopes, moderately eroded	1, 275	. 5
Watson silt loam, 8 to 15 percent slopes, moderately eroded	17	(1)
Watson silty clay loam, 8 to 15 percent slopes, severely eroded	11	(1)
Wurtsboro channery loam, 0 to 3 percent slopes	42	(1)
Wurtsboro channery loam, 3 to 8 percent slopes, moderately eroded	34	(1)
Wurtsboro very stony loam, 0 to 8 percent slopes	2, 611	1. 0
Wurtsboro very stony loam, 8 to 25 percent slopes	285	. 1
Mines, quarries, and pits	85	(1)
Water	2, 431	. 9
Total	259, 200	100. 0

[1] Less than 0.1 percent.

Albrights Series

The Albrights series consists of deep, moderately well drained, reddish-brown soils. At a depth of 25 inches, the soils are mottled and firm when moist. They have developed in 3 to 30 feet of glacial till underlain by bedrock. The till originated mainly from reddish-brown sandstone and siltstone, but partly from shale and conglomerate.

Most of the Albrights soils are stony and are wooded. Originally, the forest consisted of white pine and hemlock; at present, white oak, red maple, gray birch, and scrub oak predominate.

Many areas of Albrights soils are adjacent to the deep, well-drained Meckesville soils. They are also near areas of the moderately deep, well-drained Leck Kill, the somewhat poorly drained Alvira, the poorly drained Shelmadine, and the very poorly drained Norwich soils. The parent material of all of these is similar to that of the Albrights soils. The Albrights soils are similar to the Watson soils but are sandier.

Typical profile (Albrights very stony loam on a slope of 6 percent, in a wooded area):

A_1 0 to 1½ inches, black (5YR 2/1, dry) loam with numerous stones up to 10 inches in diameter; weak, medium, crumb structure; loose when dry; many roots; extremely acid (pH 4.4).

A_2 1½ to 4 inches, reddish-gray to dark reddish-gray (5YR 5/2 to 4/2) loam; 20 percent of mass consists of gravel and of stones up to 10 inches in diameter; weak, thin, platy structure; friable when moist; some roots; extremely acid (pH 4.4); abrupt, wavy lower boundary; layer ranges from 1 to 3 inches in thickness within a distance of a few feet.

B_1 4 to 9 inches, yellowish-red (5YR 4/7) silt loam; 10 percent of mass consists of gravel and of stones up to 8 inches in diameter; weak to moderate, fine, subangular blocky structure; friable when moist; numerous roots; very strongly acid (pH 4.6); clear, wavy lower boundary; layer ranges from 4 to 6 inches in thickness within a distance of a few feet.

B_{21} 9 to 14 inches, dark-brown (7.5YR 4/4), heavy loam; 10 percent of mass consists of gravel and of stones up to 8 inches in diameter; weak to moderate, medium, subangular blocky structure; thin, discontinuous clay films on peds; friable when moist, slightly sticky when wet; some roots; very strongly acid (pH 4.8); clear, wavy lower boundary; layer ranges from 4 to 7 inches in thickness within a distance of a few feet.

B_{22} 14 to 25 inches, reddish-brown (5YR 4/4), heavy loam; 20 percent of mass consists of gravel and of stones up to 8 inches in diameter; weak to moderate, medium, subangular blocky structure; thin, continuous clay films on peds; firm when moist, sticky when wet; few roots; very strongly acid (pH 4.6); clear, wavy lower boundary; layer ranges from 9 to 12 inches in thickness within a distance of a few feet.

B_{3g} 25 to 32 inches, reddish-brown (5YR 4/4) gravelly loam mottled gray; 30 percent of mass consists of gravel and of stones up to 8 inches in diameter; weak,

medium, platy structure; black coating of manganese oxide or iron oxide on peds; thin, discontinuous clay films; very firm when moist, extremely hard when dry; very strongly acid (pH 4.8); gradual, wavy lower boundary; layer ranges from 4 to 11 inches in thickness within a distance of a few feet.

C_{1g} 32 to 42 inches +, reddish-brown (5YR 4/4) sandy loam; 60 percent of mass consists of gravel and of stones up to 8 inches in diameter; very weak, fine, blocky structure; firm when moist.

Albrights soils in a few areas have a clay substratum, which was part of the profile of an older soil. The present profile and the older profile are commonly separated by a stone pavement, 1 inch to 2 inches thick. The texture of the Albrights soils ranges from fine sandy loam to silty clay loam; the colors in a few areas are hues ranging from 10YR to 2.5YR. Bedrock is commonly at a depth of 10 feet, but the depth ranges from 3 to 30 feet. Depth to the fragipan ranges from 18 to 30 inches, and the fragipan is weakly to strongly expressed.

The Albrights soils have slow internal drainage and are slow in permeability. In addition, they are strongly acid, low in natural fertility, and moderate in available moisture-holding capacity. Leaching of plant nutrients is moderate.

Albrights channery loam, 0 to 3 percent slopes (AaA).—This soil has been cleared of stones so that it can be farmed. It has a dark-brown surface layer when plowed. Its profile is similar to the one described as typical of the series, but this soil is more nearly level than the one described.

This soil is suitable for silage corn, small grains, and cool-season crops, except potatoes. Because of the excess water in some seasons, it is less well suited to deep-rooted crops. Closed drains, open ditches, or field terraces can be used to improve the drainage and prevent erosion. Cover crops and stubble mulching will improve the tilth and will prevent crusting and erosion. To improve crop yields, lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit IIw–2; woodland suitability group 3.)

Albrights channery loam, 3 to 8 percent slopes, moderately eroded (AaB2).—This soil has been cleared of most large stones so that it can be farmed. It has a dark reddish-brown plow layer. Part of the surface layer has been lost through erosion, and tillage has mixed subsoil with the present plow layer. The rest of the profile is similar to the one described as typical for the series.

This soil is suitable for small grains, silage corn, and cool-season crops. It can be improved for potatoes and deep-rooted crops by draining the areas. Diversion terraces and grassed waterways can be used to protect the soil from runoff and erosion. Graded stripcropping and the growing of winter cover crops can be used to improve soil tilth. To increase crop yields, lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit IIe–4; woodland suitability group 3.)

Albrights silt loam, 0 to 3 percent slopes (AbA).—This soil has been cleared of stones so that it can be farmed. It has a dark-brown surface layer when plowed. This soil is more nearly level than the soil described as typical of the series. It is also more silty, but its profile is otherwise similar. Included with it are some areas that are moderately eroded and a few that are somewhat poorly drained.

Albrights silt loam, 0 to 3 percent slopes, is suitable for most crops grown locally, especially the cool-season ones. It is not suitable for deep-rooted crops. Also, in some years, frost may be a hazard to corn and other late-maturing crops grown in the mountainous areas. Runoff is slight to moderate, but diversion terraces can be used to remove excess water and to prevent erosion. Contour farming and winter cover crops are also needed to protect and improve the soil. Lime and fertilizer will improve yields when applied according to the needs indicated by soil tests. (Capability unit IIw–2; woodland suitability group 3.)

Albrights silt loam, 3 to 8 percent slopes, moderately eroded (AbB2).—Most areas of this soil have been cleared of large stones and have been plowed for crops. Nearly half of the original surface layer, in some places, has been removed through erosion and more than half of it in others. Otherwise, except that this soil is more silty, the profile is like the one described as typical for the series. Included with this soil are areas of slightly eroded or uneroded soils, most of which are wooded.

Albrights silt loam, 3 to 8 percent slopes, moderately eroded, is suitable for most crops grown locally, especially the cool-season ones. It is not suited to deep-rooted crops. In some years frost is a hazard to corn and other late-maturing crops grown in the mountainous areas. Runoff and erosion are moderate problems. Diversion terraces, contour stripcropping, and winter cover crops are needed to protect the soil from erosion and to improve tilth. Lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit IIe–4; woodland suitability group 3.)

Albrights very stony loam, 0 to 8 percent slopes (AcB).—The profile of this soil is the one described as typical of the Albrights series. Because fires have burned over the woods, however, the A_1 horizon contains charcoal.

This soil is too stony for cultivation and is best kept in trees or pasture. Oak and maple are the most valuable trees in the present woodlands, but this soil may be better suited to white pine or hemlock. Protection from fire is needed in most areas. (Capability unit VIs–3; woodland suitability group 3.)

Albrights very stony loam, 8 to 25 percent slopes (AcD).—Except on the steeper slopes, the profile of this soil is similar to the one described as typical for the series. However, most of this soil has gradients in the lower half of the slope range. Runoff is moderate from these areas.

This soil is too stony for cultivation. It is best suited to trees or pasture. Red maple, white and red oaks, and some pine and hemlock are the most valuable trees in the present woodlands. Fire prevention is needed in most areas. (Capability unit VIs–3; woodland suitability group 3.)

Allenwood Series

The Allenwood series consists of deep, well-drained soils that are medium textured to fine textured. The subsoil is reddish, firm, and blocky and is finer textured than the surface layer. The increase in clay and the more distinct structure in the B horizon show a high degree of horizonation. The Allenwood soils have formed in old glacial deposits that have weathered deeply. The glacial deposits were derived from acid, grayish sandstone, siltstone, and

shale, or from weak, red siltstone. The soils are mainly on soft shale ridges in the Mahoning and Weatherly Valleys and in the vicinity of Big Creek. Small areas of these soils occur throughout the area that was glaciated in pre-Wisconsin time and are mapped as inclusions with other soils.

Most areas of Allenwood soils are used as cropland. Some are in townsites, and a few areas are wooded or idle. The native vegetation was white pine, hemlock, and red and white oaks.

Allenwood soils are adjacent to the moderately well drained Watson, the somewhat poorly drained Alvira, and the poorly drained Shelmadine soils. All of these soils have formed in similar parent material.

Typical profile (Allenwood gravelly silt loam, 3 to 8 percent slopes, moderately eroded, in cropland):

A_p 0 to 11 inches, dark yellowish-brown to yellowish-brown (10YR 4/4 to 5/4) silt loam; 20 percent of mass is gravel most of which is rounded; weak, fine, granular structure; friable when moist, slightly plastic when wet; many roots; neutral (pH 6.6); clear, irregular lower boundary; layer ranges from 9 to 14 inches in thickness within a distance of a few feet.

B_1 11 to 14 inches, dark-brown (7.5YR 4/4), heavy silt loam with a few specks of white; 20 percent of mass is gravel most of which is rounded; weak, fine to medium, subangular blocky structure; thin, discontinuous clay films on peds; friable when moist, slightly plastic and sticky when wet; some pores coated with surface soil; neutral (pH 6.8); clear, wavy lower boundary; layer ranges from 2 to 5 inches in thickness within a distance of a few feet.

B_{21} 14 to 18 inches, red (2.5YR 5/8) silty clay loam with specks of gray and white; 30 percent of mass is gravel most of which is rounded; moderate, fine to medium, blocky to subangular blocky structure; thick, continuous clay films on peds; firm when moist, slightly plastic when wet; some pores coated with surface soil; neutral (pH 6.8); gradual, wavy lower boundary; layer ranges from 3 to 5 inches in thickness within a distance of a few feet.

B_{22} 18 to 25 inches, light-red to red (2.5YR 6/8 to 5/8), heavy silty clay loam with specks of gray and white; 30 percent of mass is gravel most of which is rounded; moderate, fine and medium, blocky structure; thick, continuous clay films on peds; firm, sticky, and plastic when wet; pores coated with surface soil; very slightly acid (pH 6.4); gradual, wavy lower boundary; layer ranges from 5 to 9 inches in thickness within a distance of a few feet.

B_{23} 25 to 32 inches, red (2.5YR 5/8) silty clay loam with specks of gray and white; 30 percent of mass is gravel; moderate, medium and fine, blocky structure; thick, continuous clay films on peds; firm, sticky and plastic when wet; neutral (pH 6.6); gradual, wavy lower boundary; layer ranges from 5 to 9 inches in thickness within a distance of a few feet.

B_3 32 to 36 inches, red (2.5YR 4/8) silty clay loam with specks of gray and white; 30 percent of mass is gravel; weak, medium, blocky and platy structure; many fine coatings of manganese and thick, discontinuous clay films on peds; firm, sticky, and slightly plastic when wet; slightly acid (pH 6.0); clear, irregular lower boundary; layer ranges from 2 to 6 inches in thickness within a distance of a few feet.

C_1 36 to 43 inches, red to light-red (2.5YR 4/6 to 6/6) loam to silt loam with gray and white specks the size of a pinhead; 30 percent of mass is gravel; weak, thin to medium, platy structure; few, medium manganese and clay films on peds; firm; alfalfa roots to a depth of 39 inches; strongly acid (pH 5.2).

C_2 43 to 96 inches +, red (2.5YR 4/8) loam to silt loam; some smooth, rounded cobbles as much as 6 inches in diameter; very strongly acid (pH 4.8).

In places the texture of the surface layer is shaly silt loam; in others it is gravelly, heavy silt loam; gravelly loam; stony loam; or channery silt loam. The subsoil ranges from friable to firm clay loam to gravelly loam. In some areas the profile is lighter textured and contains more coarse fragments than the profile described as typical of the series. In these places the subsoil is also more friable than that in the profile described. The color of the C horizon ranges from yellowish brown to weak red or dusky red. Most of the areas in which the C horizon is dusky red are in the Weatherly and Quakake Valleys. Bedrock is generally at a depth of about 6 feet, but the depth ranges from 3 to about 20 feet. In one place in the county, the depth to hard rock is 180 feet.

The capacity to hold available moisture for growing plants is moderately high in these soils. Permeability is moderate, and the leaching of plant nutrients is slow. In areas that have not been limed, the soil is very strongly acid. Natural fertility is medium to low.

Allenwood gravelly loam and silt loam, 0 to 3 percent (AdA).—Except for having a thicker surface layer, the profiles of the soils in this mapping unit are similar to the one described as typical for the series. Included are a few small, moderately eroded areas and a few areas in which stones or cobbles are on the surface.

Allenwood gravelly loam and silt loam, 0 to 3 percent slopes, is suited to all of the crops and trees commonly grown in the county. Contour farming, a good cropping system, and cover crops are needed to conserve the soils and maintain them in good tilth. Runoff and erosion are slight. Lime and fertilizer should be applied according to needs indicated by soil tests. (Capability unit I–2; woodland suitability group 1.)

Allenwood gravelly loam and silt loam, 3 to 8 percent slopes, moderately eroded (AdB2).—In this mapping unit the profiles of the soils are like the one described as typical for the Allenwood series. Small areas of slight or of no erosion, areas of severe erosion, and a few areas in which stones and cobbles are on the surface are included.

Allenwood gravelly loam and silt loam, 3 to 8 percent slopes, moderately eroded, has moderate runoff and a moderate hazard of erosion. The soils are suitable for all of the crops and trees commonly grown in the county. Corn, market vegetables, small grains, and hay and pasture crops grow well, especially if supplied with adequate plant nutrients. Contour farming and winter cover crops are needed to control runoff and erosion. Diversion terraces may be needed on the long slopes. Additional organic matter is needed to improve the tilth and porosity of the soils. (Capability unit IIe–1; woodland suitability group 1.)

Allenwood gravelly loam and silt loam, 8 to 15 percent slopes, moderately eroded (AdC2).—The profile of these soils resembles the one described as typical of the series, except that the subsoil contains more coarse material and is more friable. Included with these soils are areas of slight or no erosion.

Erosion is a hazard on Allenwood gravelly loam and silt loam, 8 to 15 percent slopes, moderately eroded, because of the strong slopes. These soils are suitable for all of the crops and trees commonly grown in the county. Terraces, cover crops, and stripcropping are needed to control erosion and to maintain soil tilth. To insure good yields, lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit IIIe–1; woodland suitability group 2.)

Allenwood gravelly silt loam, 0 to 3 percent slopes (AgA).—This soil is on broad, nearly level ridges. It has a darker brown surface layer and contains less silt and clay than the soil described as typical for the Allenwood series. Included are some slightly eroded areas having gradients in the upper part of the slope range.

Allenwood gravelly silt loam, 0 to 3 percent slopes, is among the most productive and easily worked soils in the county. It has few problems that limit its use for cultivated crops. The soil is well suited to all of the crops commonly grown in the area, especially to potatoes. Crops should be grown on the contour. The cropping system needs to include legumes and grasses to protect the soil and to maintain organic matter and tilth. Fertilizer and lime ought to be applied according to the needs indicated by soil tests. (Capability unit I–2; woodland suitability group 1.)

Allenwood gravelly silt loam, 3 to 8 percent slopes, moderately eroded (AgB2).—The profile of this soil resembles the one described as typical for the series, except that it has a darker surface layer, is shallower, and contains less hard gravel. Included are small areas of slight or of no erosion and a few in which sheet erosion has been severe.

Allenwood gravelly silt loam, 3 to 8 percent slopes, moderately eroded, is on rolling ridges and on the moderate slopes of ridges. The main problems are the control of erosion and the maintenance of soil tilth and fertility.

The soil is suited to all the crops commonly grown in the county, especially to potatoes. Contour stripcropping and cover crops are needed to protect it from erosion and to hold rain where it falls. Fields on long slopes may need terraces and grassed outlets to remove excess water safely. Lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit IIe–1; suitability group 1.)

Allenwood gravelly silt loam, 8 to 15 percent slopes, moderately eroded (AgC2).—The profile of this soil resembles the one described as typical for the series, except that it is shallower, contains more coarse fragments, and has a darker brown surface layer. The subsoil is also somewhat more friable. Small areas of the Leck Kill and Klinesville soils are included because of the nature of the folded strata.

Allenwood gravelly silt loam, 8 to 15 percent slopes, moderately eroded, occupies a small area in the vicinity of Weatherly, where it is on the sides of moderately to strongly sloping ridges. Erosion is a severe hazard. Management is needed to improve and protect the soil.

Most general farm crops and trees grow well on this soil. Maintenance of fertility and organic matter and the control of runoff are the main management problems. Rotation of crops, contour stripcropping, diversion terraces, and cover or green-manure crops are needed to protect and improve the soil. For high crop yields, lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit IIIe–1; woodland suitability group 2.)

Allenwood gravelly silt loam, 15 to 25 percent slopes, moderately eroded (AgD2).—The profile of this soil is similar to the one described as typical for the series, except that it contains more coarse material and has a more friable subsoil. Surface runoff is greater on this soil and infiltration less than in the typical soil. Included are a few woodland areas that are slightly eroded or uneroded.

Allenwood gravelly silt loam, 15 to 25 percent slopes, moderately eroded, is better suited to hay, pasture, or trees than to cultivated crops. Erosion is a moderate hazard, and the strong slopes make the operation of machinery difficult. Fields intended for pasture should be seeded in strips and protected by diversion terraces. Cultivated fields need to be kept under a cover of plants and tilled on the contour. They also should be protected by terraces. To obtain good yields of crops, apply lime and fertilizer according to the needs indicated by soil tests. (Capability unit IVe–1; woodland suitability group 2.)

Allenwood gravelly silty clay loam, 8 to 15 percent slopes, severely eroded (AmC3).—This soil has lost most of its original surface layer. Its profile is similar to the one described as typical for the Allenwood series, except that the present surface layer is finer textured, has more coarse fragments near the surface, and has a more friable subsoil. A few gullied areas are included.

Controlling runoff and erosion and maintaining soil tilth are the main problems in managing Allenwood gravelly silty clay loam, 8 to 15 percent slopes, severely eroded. Diversions and grassed waterways, stripcropping, and winter cover crops are needed to protect and improve the soil. Sod crops should be grown in the cropping system at least 4 years in 5. Apply lime and fertilizer according to the needs indicated by soil tests. (Capability unit IVe–1; woodland suitability group 2.)

Allenwood gravelly silty clay loam, 15 to 25 percent slopes, severely eroded (AmD3).—This soil has lost most of the original surface layer, and clods from the reddish B horizon are near the surface. The profile resembles the one described as typical for the Allenwood series, but this soil is more eroded, has a greater number of coarse fragments in the subsoil, and is shallower over the C horizon. The C horizon is generally at a depth of about 30 inches.

Because this soil needs to be kept under a cover of plants, it is better suited to hay and pasture than to cultivated crops. It is also suited to trees. Runoff, erosion, and the difficulty of operating farm machinery are management problems. Runoff can be diverted by constructing diversions where excess water concentrates. Lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit VIe–1; woodland suitability group 2.)

Alvira Series

The Alvira series consist of somewhat poorly drained soils that are medium textured. The surface layer is dark brown and overlies yellowish-brown soil material. A strongly developed, prominently mottled fragipan is at a depth of 14 to 20 inches.

The Alvira soils have formed in medium-textured, old, deep glacial till. The till was derived mostly from grayish sandstone but partly from varying amounts of shale, siltstone, conglomerate, and quartzite, some of it red. The soils are nearly level to gently sloping and are mainly on the lower parts of slopes. Except for a large area near Hickory Run State Park in Kidder Township, most areas of Alvira soils are small and are scattered throughout the county.

The Alvira soils have formed in parent material like that of the Allenwood, Watson, Shelmadine, Hazleton, Drifton, Lickdale, and Tughill soils. Alvira soils are more poorly

drained than the Allenwood, Watson, Hazleton, and Drifton soils, but they are better drained than the Shelmadine, Lickdale, and Tughill soils. The Alvira soils are in positions higher than those occupied by the Shelmadine, Lickdale, and Tughill soils and lower than those occupied by the Allenwood, Watson, Hazleton, and Drifton soils.

Typical profile (Alvira very stony loam, 0 to 8 percent slopes, in a wooded area):

- A_0 1½ inches to 0, black (N 2/0) decayed leaves with some charcoal; many stones up to 3 feet in diameter; many roots; extremely acid (pH 4.4); abrupt, wavy lower boundary; layer ranges from 1 to 2 inches in thickness within a distance of a few feet.
- A_2 0 to 4 inches, dark reddish-brown (5YR 3/2) loam; weak, medium, platy structure breaks to weak, fine, granular; friable; many roots; extremely acid (pH 4.2); clear, wavy lower boundary; layer ranges from 3 to 5 inches in thickness within a distance of a few feet.
- B_{1ir} 4 to 5½ inches, dark-brown (7.5YR 4/2 to 3/2), heavy loam; weak, thin to medium, platy structure; friable; many roots; very strongly acid (pH 4.6); clear, wavy lower boundary; layer ranges from 1 to 2 inches in thickness within a distance of a few feet.
- B_1 5½ to 9½ inches, dark-brown (7.5YR 4/4), light silt loam with tongues of dark brown (7.5YR 4/2 and 3/2); weak, fine, subangular blocky structure; friable; some roots; very strongly acid (pH 4.7); clear, wavy lower boundary; layer ranges from 4 to 6 inches in thickness within a distance of a few feet.
- B_{21} 9½ to 15 inches, yellowish-brown (10YR 5/4), light silt loam; moderate, thin, platy structure; friable to firm, sticky when wet; few roots; very strongly acid (pH 4.9); gradual, wavy lower boundary; layer ranges from 4 to 7 inches in thickness within a distance of a few feet.
- B_{22x} 15 to 21 inches, yellowish-brown (10YR 5/4) gravelly silty clay loam; few, fine, distinct mottles of strong brown (7.5YR 5/8); large polygons separated by lenses of sand, breaking to moderate, medium, platy to moderate, medium, subangular blocky structure; thin, discontinuous clay films on peds; firm, slightly plastic when wet; very strongly acid (pH 4.8); gradual, wavy lower boundary; layer ranges from 4 to 8 inches in thickness within a distance of a few feet.
- B_{23x} 21 to 29 inches, light pale-brown (10YR 6/3) gravelly silty clay loam; common, medium, and prominent mottles of strong brown (7.5YR 5/8); moderate, medium, prismatic structure breaking to moderate, medium, subangular blocky; thin, discontinuous clay films on peds; very firm, slightly plastic when wet; very strongly acid (pH 4.8); gradual, irregular lower boundary; layer ranges from 6 to 11 inches in thickness within a distance of a few feet.
- B_3 29 to 36 inches, light yellowish-red (5YR 5/6), light sandy clay loam; moderate, thin, platy structure; very firm; very strongly acid (pH 4.9).
- C 36 inches +, light yellowish-red gravelly sandy clay loam; some platiness; firm; material extends to a depth of about 10 feet, but it may be much deeper to bedrock.

In places the texture of the surface layer is stony loam, but in other places it is gravelly silt loam, loam, or silt loam. The subsoil ranges in texture from gravelly loam to silty clay loam. In some areas the color of the subsoil is yellowish brown, but in others it is reddish brown or light yellowish red, depending on the degree of weathering. In some areas occasional reddish stones give the subsoil a redder color. In some places cobbles and stones are more abundant than in the profile described. Bedrock is at a depth of 6 to 18 feet, but it is as shallow as 3 feet in the soils on the folded strata.

Permeability and internal drainage are slow because of the fragipan, slope, position, and fluctuating high water table. Seepage from higher areas and from wet-weather springs is common. The available moisture-holding capacity is moderately low. Alvira soils are naturally extremely acid. Leaching of plant nutrients is moderately slow.

Alvira gravelly silt loam, 0 to 8 percent slopes (AnB).—This soil has a dark-brown plow layer that is 6 to 8 inches thick. Stones that were on the surface have been removed so that the areas could be farmed. In other respects the profile of this soil is similar to that described as typical for the series. This soil includes some small, poorly drained, depressed areas and a few nearly level or gently sloping areas that have been slightly or moderately eroded.

Alvira gravelly silt loam, 0 to 8 percent slopes, is suited to most of the crops commonly grown in the county, and fair yields can be expected. It is not suited to deep-rooted crops, but hay and pasture, consisting of birdsfoot trefoil and reed canarygrass (*Phalaris arundinacea*), grow well. Trees are also suited, but windthrow may be a problem when they grow tall. The soil is suited to development of wildlife areas, particularly to areas making use of farm ponds.

Runoff is slow, and the hazard of erosion is only moderate. Extensive artificial drainage, consisting of diversions and closed systems, is needed to remove excess moisture. (Capability unit IIIw–1; woodland suitability group 4.)

Alvira very stony silt loam, 0 to 8 percent slopes (ArB).—The profile of this soil is similar to the one described as typical of the series, but in some areas it contains cobbles and stones. Included with this soil are small tracts of poorly drained soils in seepage areas and in depressions.

Alvira very stony silt loam, 0 to 8 percent slopes, is too stony for cultivation. Because it is stony and wet, it is suited only to pasture, trees, or wildlife areas. It should be kept under a cover of vegetation to protect the watershed. The growth of trees on this soil may be slowed or influenced by wetness and by shallowness to the pan. The trees have shallow root systems, and large trees are subject to windthrow. (Capability unit VIs–4; woodland suitability group 4.)

Alvira and Shelmadine silt loams, 0 to 3 percent slopes (AsA).—This mapping unit consists of Alvira and Shelmadine soils that could not be mapped separately. The profiles of the component soils are less stony and less clayey than those described as typical for the Alvira and Shelmadine series. Small areas that have been moderately sheet eroded are included.

The soils in this mapping unit are at the bases of drainageways and long slopes. They have poor to somewhat poor natural drainage. Runoff is slow, and there is a slight hazard of erosion. Both surface and subsurface drainage are needed to reduce runoff and to improve these soils for crops. In areas where runoff concentrates, open ditches and diversions will provide proper drainage and control erosion. Closed drains can be used in seepage areas.

These soils are suited to hay and pasture. Grasses and legumes that have relatively shallow roots and can tolerate wetness should be grown. Lime and fertilizer ought to be applied according to the needs indicated by soil tests. (Capability unit IIIw–1; woodland suitability group 4.)

Alvira and Shelmadine silt loams, 3 to 8 percent slopes, moderately eroded (AsB2).—The profiles of these soils

are somewhat redder than those described as typical for the Alvira and Shelmadine series. The soils are near the headwaters of streams and near areas of Allenwood and Watson soils. Included with this mapping unit are slightly eroded or uneroded areas of woodland.

Natural drainage is somewhat poor to poor in the soils of this mapping unit. Because permeability is slow, runoff is rapid and the risk of erosion is moderately high. Diversion terraces, grassed waterways, and closed drains should be installed to help control runoff and remove excess water.

These soils are moderately well suited to oats, ladino clover, birdsfoot trefoil, reed canarygrass, and shallow-rooted crops. Lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit IIIw–1; woodland suitability group 4.)

Alvira and Shelmadine very stony silt loams, 0 to 8 percent slopes (AtB).—These soils are mainly near areas of Meckesville and Albrights soils, but other areas are at the bases of long colluvial slopes. The soils at the bases of the slopes are coarser textured than the ones described as typical of the Alvira and Shelmadine series, and the pan is more strongly expressed.

The soils in this mapping unit are suited to pasture or trees, but they are too stony for cultivation. Hemlock, gray birch, and red maple are the chief kinds of trees in the woodlands. Improved management can result in the better growth of the trees. It will also improve the composition of the woodlands and help provide better markets for forest products. (Capability unit VIs–4; woodland suitability group 4.)

Andover Series

Soils of the Andover series have a grayish-brown surface layer and a strongly mottled, grayish subsoil. They are poorly drained and have formed in deep materials derived from sandstone, conglomerate, and quartzite worked by glaciers. These soils are in the coal region, near Stony Ridge, and in small areas at the bases of mountain slopes. Their surface is uneven, and water stands in pockets most of the time.

The native vegetation on these soils was hemlock and white pine. Because of heavy cutting and fires, red maple and gray birch mixed with some pitch pine and white oak are now the main species.

The Andover soils are near areas of Fleetwood, Natalie, Laidig, and Buchanan soils, all of which have formed from similar parent material. Only one soil of this series, Andover very stony loam, 0 to 3 percent slopes, has been mapped.

Typical profile (Andover very stony loam, 0 to 3 percent slopes, wooded):

A_{00} 3 inches to 1 inch of hardwood leaf litter.

A_0 1 inch to 0, black (N 2/0), decomposed leaf litter containing some charcoal; many roots; numerous stones up to 18 inches in diameter.

A_1 0 to 2 inches, brown (10YR 5/3) very stony loam; weak, fine, subangular blocky structure; friable; many roots; extremely acid (pH 4.4).

A_{2g} 2 to 4 inches, dark grayish-brown (10YR 4/2) very stony loam; brown (7.5YR 5/4) mottles common; thin, platy structure; friable; some roots; very strongly acid (pH 4.6).

B_{1g} 4 to 12 inches, gray (N 5/0) loam; many, medium, prominent mottles of brown (7.5YR 5/4), strong brown (7.5YR 5/6), and yellowish brown (10YR 5/6); weak, medium, blocky structure; friable; few roots; very strongly acid (pH 4.6).

B_{21g} 12 to 24 inches, gray (N 6/0) loam; common, course, prominent mottles of yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and brown (7.5YR 5/4); weak, medium, platy structure; friable when moist, slightly sticky when wet; very strongly acid (pH 4.8).

B_{22g} 24 to 28 inches, gray (N 6/0) loam grading to sandy clay loam in lower part; common, coarse, prominent mottles of yellowish brown (10YR 5/4); moderate, thin, platy structure; thick, discontinuous clay films on peds; firm when moist, sticky when wet; strongly acid (pH 5.0).

C_m 28 to 29 inches +, gravelly loam; massive; very firm when moist.

The surface layer of the Andover soils ranges from nonstony to extremely stony; stone stripes on the surface are common. In a few nonstony areas, the texture of the surface layer is silt loam. Bedrock is at a depth of 4 to 20 feet or more.

Andover soils are in low positions and receive much water from higher lying areas. The firm till restricts drainage of water through the soil. Permeability and internal drainage are very slow. The capacity to hold available moisture for plant growth is low. Leaching of plant nutrients is slow, and the soils are very acid.

Andover very stony loam, 0 to 3 percent slopes (AvA).—The profile of this soil is like the one described as typical of the Andover series. Included with it, however, are small areas that are nonstony or that are extremely stony.

Andover very stony loam, 0 to 3 percent slopes, is too stony and wet for cultivated crops. It is better used for wildlife areas or to grow vegetation to protect the watershed. This soil is suited to trees, but the excessive wetness hinders the growth of trees. (Capability unit VIIs–1; woodland suitability group 4.)

Buchanan Series

This series consists of deep, moderately well drained to somewhat poorly drained soils that have a yellowish-brown to strong-brown surface layer. The subsoil is yellowish brown to dark brown and is somewhat mottled. A hardpan that is 5 to 18 inches thick is at a depth of 20 to 24 inches.

The Buchanan soils have formed in colluvium that originated from mixed grayish and reddish sandstone, shale, siltstone, and conglomerate. They occupy the less well drained lower slopes at the bases of steep mountains. Most areas of the Buchanan soils are still wooded.

The native vegetation on these soils consisted of red and white oaks, red maple, white pine, tulip-poplar, chestnut, and hemlock. The present woodlands consist mainly of red, white, and chestnut oaks and red maple; white pine and hemlock are present in lesser amounts.

The Buchanan soils are in positions below and in many places adjacent to the well-drained Laidig soils. The Buchanan and Laidig soils have formed from similar parent material.

Typical profile (Buchanan very stony loam, 8 percent slopes, wooded):

A_{00} 2 inches to 1 inch of leaf litter from hardwoods.

A_{00} 1 inch to 0, black (5YR 2/1) mor; 50 percent of mass consists of coarse material up to 18 inches in diameter; many roots; very strongly acid (pH 4.6); abrupt, wavy boundary; layer ranges from ½ to 2 inches in thickness within a distance of a few feet.

A_2 0 to 2 inches, grayish-brown (10YR 5/2) stony loamy sand; 50 percent of mass consists of coarse material

up to 18 inches in diameter; weak, thin, platy structure; friable when moist; few roots; very strongly acid (pH 4.8); abrupt, irregular lower boundary; layer ranges from 1 to 4 inches in thickness within a distance of a few feet.

B_{1ir} 2 to 5 inches, dark yellowish-brown (10YR 4/4) silt loam; 30 percent of mass consists of coarse fragments up to 18 inches in diameter; weak, fine, granular structure; friable when moist, slightly sticky when wet; many roots; strongly acid (pH 5.4); clear, broken lower boundary; layer ranges from 0 to 4 inches in thickness within a distance of a few feet.

B_{21} 5 to 13 inches, yellowish-brown (10YR 5/6) gravelly sandy loam; 30 percent of mass consists of coarse fragments up to 18 inches in diameter; weak, medium, subangular blocky structure; thin, discontinuous clay films on peds; friable when moist, slightly sticky when wet; numerous roots; strongly acid (pH 5.2); gradual, wavy lower boundary; layer ranges from 6 to 10 inches in thickness within a distance of a few feet.

B_{22} 13 to 24 inches, yellowish-brown (10YR 5/8), stony, light sandy clay loam; 20 percent of mass consists of coarse material up to 18 inches in diameter; weak, medium, prismatic structure breaks to weak, medium, subangular blocky; thin, continuous clay films on peds; friable when moist, slightly sticky when wet; some roots; very strongly acid (pH 5.0); clear, wavy lower boundary; layer ranges from 9 to 13 inches in thickness within a distance of a few feet.

B_{3g} 24 to 36 inches, yellowish-brown (10YR 5/6, dry), stony, gravelly, heavy loam; common, medium, distinct mottles of strong brown (7.5YR 5/8, dry) and pale brown (10YR 6/3, dry); 15 percent of mass consists of coarse fragments up to 18 inches in diameter; moderate, medium, blocky and platy structure; thin, discontinuous clay films on peds; hard to very hard when dry, slightly sticky when wet; very strongly acid (pH 4.9); diffuse, wavy lower boundary; layer ranges from 5 to 18 inches in thickness within a distance of a few feet.

C 36 to 40 inches +, yellowish-brown (10YR 5/6) stony loamy sand; few, medium, distinct mottles of strong brown (7.5YR 5/6); 10 percent of mass consists of coarse material up to 18 inches in diameter; weak, thin to medium, platy structure; firm when moist; very strongly acid (pH 4.8).

The Buchanan soils are extremely variable in texture, in color, in depth, and in parent material. Their color ranges in hue from 5YR to 10YR; their texture, from silt loam to clay loam; and depth to bedrock, from 4 to 30 feet. The parent material is mainly a mixture of materials weathered from gray and red sandstone, siltstone, and conglomerate but contains some shale. Where these soils occur in the vicinity of the red beds, their color ranges to 5YR, and their texture is heavier than in areas that occur elsewhere in the county.

The Buchanan soils are moderate to slow in permeability. The capacity for holding moisture available for plants is moderate. The soils are naturally strongly acid. Leaching of plant nutrients is moderately slow.

Buchanan gravelly loam, 3 to 10 percent slopes, moderately eroded (BcB2).—This soil has a plow layer that is very dark grayish brown. The surface layer is gravelly and cobbly, rather than stony, but the profile is similar to the profile described as typical of the series. About half the original surface layer has been lost through erosion. Included in this unit are some severely eroded areas.

Buchanan gravelly loam, 3 to 10 percent slopes, moderately eroded, is well suited to most crops commonly grown in the county, except the deep-rooted ones. Because it is sloping, receives runoff from higher areas, and has a hardpan that restricts the movement of water in the soil, it is subject to severe erosion. To control runoff and erosion, a combination of practices is needed. Diversion terraces, together with stripcropping, need to be used on slopes, and closed drains should be installed in the seepy areas. Winter cover crops ought to be grown to keep the soil surface porous and to give protection from erosion. Lime and fertilizer, applied according to the needs indicated by soil tests, will improve crop yields. (Capability unit IIe-4; woodland suitability group 3.)

Buchanan very stony loam, 0 to 8 percent slopes (BhB).—This soil occupies nearly level areas in Packer Township, and it is on moderate slopes elsewhere in the county. Its profile is similar to the one described as typical of the series. It is too stony for cultivation.

This soil is suited to pasture or trees. It is near streams, and the vegetation on it should be managed to protect the watershed. In wooded areas mature trees need to be thinned and harvested, and crooked and crowded trees removed. The prevention of woodland fires is a serious management problem. (Capability unit VIs-3; woodland suitability group 3.)

Buchanan very stony loam, 8 to 25 percent slopes (BhD).—This soil has a profile like the one described as typical of the series. Most of the areas are in the lower and middle range of the slope group.

This soil is too stony for cultivation, but it is suited to pasture and trees. It is near streams, and the vegetation on it should be managed to protect the watershed. Most of the woodlands are well stocked, but the trees need to be thinned and harvested selectively to obtain the best growth and highest yields. The prevention of fire is a serious problem. (Capability unit VIs-3; woodland suitability group 3.)

Comly Series

The Comly series consists of moderately well drained to somewhat poorly drained soils that have a weak pan at a depth of 15 to 20 inches. The soils have formed from moderately deep material worked by glaciers. The parent material weathered from thin-bedded, gray, acid shale and siltstone. The Comly soils are mostly between Indian Hills and Stony Ridge.

The native vegetation on the Comly soils was mainly hemlock and white pine, but included some red, black, and white oaks. The present woodlands on the few areas still in trees consist mainly of red and white oaks and red maple.

Comly soils have formed in parent material that is similar to that of the Montevallo, Hartleton, and Shelmadine soils, and these soils all occur in the same general area. Comly soils are deeper and are in lower positions than the shallow, well-drained Montevallo soils; they are shallower and are in lower positions than the deep, well-drained Hartleton soils; and they are above, or adjacent to, and somewhat better drained than the deep, poorly drained Shelmadine soils.

Typical profile (Comly silt loam, 3 to 8 percent slopes, moderately eroded):

A_p 0 to 11 inches, dark grayish-brown (2.5Y 4/2) silt loam; weak, medium, granular structure; friable when moist; many roots; neutral (pH 6.7); abrupt, wavy lower boundary; layer ranges from 10 to 12 inches in thickness within a distance of a few feet.

B_2 11 to 18 inches, yellowish-brown (10YR 5/4), light silty clay loam; moderate, fine to medium, blocky struc-

ture; friable when moist; some roots; pores and wormholes coated dark grayish brown (2.5Y 4/2); slightly acid (pH 6.4); clear, wavy lower boundary; layer ranges from 5 to 9 inches in thickness within a distance of a few feet.

A'_{2g} 18 to 20 inches, yellowish-brown (10YR 5/4), heavy silt loam; common, fine, distinct mottles of yellowish brown (10YR 5/8) and light gray (2.5Y 7/2); moderate, fine, blocky structure; firm when moist; few roots; some pores and wormholes coated with dark grayish brown (2.5Y 4/2); slightly acid (pH 6.2); gradual, irregular lower boundary; layer ranges from 1 to 5 inches in thickness within a distance of a few feet.

B'_{2g} 20 to 24 inches, light brownish-gray (2.5Y 6/2) silty clay loam; common, medium, distinct mottles of light gray (2.5Y 7/2) and yellowish brown (10YR 5/8); weak, fine to medium, subangular blocky structure; thick, continuous clay films on peds; very firm when moist, sticky when wet; few roots; acid (pH 5.9); clear, irregular lower boundary; layer ranges from 3 to 7 inches in thickness within a distance of a few feet.

C_1 24 to 27 inches, yellowish-brown (10YR 5/4 to 6/4) loam; many, fine, prominent mottles of yellowish brown (10YR 5/8) and white (2.5Y 8/2); weak, fine, blocky structure; slightly hard when dry, very firm when moist; slightly acid (pH 6.1); clear, wavy lower boundary; layer ranges from 2 to 4 inches in thickness within a distance of a few feet.

C_2 27 to 34 inches +, strong-brown (7.5YR 5/6) fine shaly loam; medium acid (pH 5.6).

The texture of the B_2 horizon ranges from silty clay loam to clay loam. The clay films on the peds in the B'_{2g} horizon range from thin to thick. Depth to the C_1 horizon ranges from 15 to 35 inches, and the color in this horizon ranges from hue of 2.5Y to 5YR. Mottles are at a depth of 15 to 30 inches, and bedrock is at a depth of 24 to 72 inches. The structure ranges from subangular blocky to blocky or platy. The parent material in places contains a few pebbles and fragments of sandstone.

The B'_{2g} horizon in the Comly soils is firm and is slowly permeable. The capacity for holding moisture available for plants is moderate, and the leaching of plant nutrients is slow. The Comly soils are strongly acid.

Comly silt loam, 0 to 3 percent slopes (CmA).—The profile of this soil is similar to the one described as typical for the series. This soil, however, is only slightly eroded. In places its profile is thicker than the profile described and the soil has formed in parent material that is more loamy than typical. There is little runoff and only a slight hazard of erosion. Included in this unit are small areas that are moderately eroded. Also included are very small areas of poorly drained soils in depressions.

Comly silt loam, 0 to 3 percent slopes, is suited to corn and small grains, but hay and pasture plants also grow well. The corn and small grains need to be rotated, grown in graded strips, and given ample lime and fertilizer according to the needs indicated by soil tests. In addition, the surface and subsurface drainage should be improved to obtain satisfactory yields. Cover crops are needed to protect the soil in winter. Allow grazing and the use of farm machinery only when the soil is not wet. (Capability unit IIw–2; woodland suitability group 3.)

Comly silt loam, 3 to 8 percent slopes, moderately eroded (CmB2).—The profile of this soil is like the one described as typical of the series. Included with this soil are some slightly eroded areas and some that are severely eroded. Runoff and erosion are problems when the soil is farmed by the usual methods.

This soil is well suited to pasture and hay. If it is drained and protected from erosion, it is also suited to most of the other crops grown in the county. Diversion terraces, closed drains, crops grown in rotation and in graded strips, and cover crops are needed to protect and improve the soil. Lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit IIe–4; woodland suitability group 3.)

Comly silt loam, 8 to 15 percent slopes (CmC).—The profile of this soil is like the one described as typical of the series, but this soil is less eroded. A thin, black layer, consisting mostly of organic matter from rotted leaves, covers the surface. Wet-weather springs and seeps are common.

This soil is inextensive and is mainly in trees. The principal kinds of trees are red oak, white ash, and hemlock. In most areas the trees are overmature and need to be harvested. (Capability unit IIIe–5; woodland suitability group 3.)

Comly silty clay loam, 8 to 15 percent slopes, severely eroded (CnC3).—This soil has a dark yellowish-brown plow layer that is less friable than that in the profile described as typical of the series. The plow layer is underlain by about 20 inches of yellowish-brown, heavy silt loam or silty clay loam that overlies parent material of shaly loam. Permeability is slower and the available moisture-holding capacity is lower in this soil than in the soil described as typical of the series.

Because this soil is wet, shallow, and easily eroded, it is better suited to permanent hay or pasture than to cultivated crops. Diversion terraces and random closed drains are needed to drain and protect the soil. To increase yields of forage plants, lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit IVe–4; woodland suitability group 3.)

Comly very stony silt loam, 0 to 8 percent slopes (CoB).—This soil has a very thin, black surface layer that consists mostly of organic matter that overlies a yellowish-brown layer of silt loam. Many stones up to 6 feet in diameter are on the surface. The rest of the profile is similar to the one described as typical for the series.

This soil has too many stones for cultivation, but it is suited to pasture or trees. The present woodlands consist mainly of second- and third-growth red maple with some birch, hemlock, sassafras, and oak. Nearly all of this soil is on slopes that face north to northeast, and moisture relations are, therefore, most favorable for woodland management. Other uses of the woodlands are for wildlife habitats and protection of the watershed. (Capability unit VIs–3; woodland suitability group 3.)

Comly very stony silt loam, 8 to 25 percent slopes (CoD).—This soil is similar to Comly very stony silt loam, 0 to 8 percent slopes, except that it has stronger slopes. Nearly all of it is on the north and northwestern slopes of Stony Ridge.

This soil has too many stones for cultivation and is better used for pasture or trees. Some of the included areas, however, are extremely stony and are not well suited to young trees. Red maple, birch, hemlock, sassafras, and oak are the main trees in the present woodlands. (Capability unit VIs–3; woodland suitability group 3.)

Conotton Series

The Conotton series consists of well-drained, medium-textured soils underlain by pebbles and cobbles at a depth of about 24 inches. The soils are along the major streams above areas that are normally flooded. They are mainly in the southern part of the county. The soils have formed in glacial outwash consisting mainly of material from gray sandstone, siltstone, and shale. The material was deposited by the melt water of glaciers, and the surface is slightly irregular. In this county the Conotton soils are the only ones formed in this type of parent material.

In the original woodlands white pine, white and red oaks, tulip-poplar, and hickory were the main kinds of trees. The present woodlands are primarily red maple.

Typical profile (Conotton gravelly loam, 0 to 3 percent slopes, cultivated):

A_p 0 to 8 inches, very dark grayish-brown (10YR 3/2) gravelly loam; weak, fine, granular structure; very friable; slightly acid (pH 6.4); abrupt, smooth lower boundary.

B_{21} 8 to 17 inches, dark-brown (7.5YR 4/4) gravelly sandy clay loam; weak to moderate, medium, subangular blocky structure but breaks to fine, subangular blocky; thin, discontinuous clay films on peds and in pores; friable, slightly sticky when wet; neutral (pH 6.8); gradual, wavy lower boundary; layer ranges from 7 to 11 inches in thickness within a distance of a few feet.

B_3 17 to 22 inches, dark-brown (10YR 4/3) gravelly sandy loam; weak, medium, granular structure; clay and silt films on sand grains; neutral (pH 6.8); gradual, wavy lower boundary; layer ranges from 3 to 7 inches in thickness within a distance of a few feet.

C 22 to 30 inches +, dark yellowish-brown (10YR 3/4) gravelly coarse sand; 10 percent of mass consists of brown to pale-brown (10YR 5/3 to 6/3) ghosts of chert or cherty limestone; single grain; loose when moist; neutral (pH 6.8).

In places the texture of the surface layer in the Conotton soils is gravelly loam, and in other places it is gravelly silt loam or gravelly cobbly silt loam. The texture of the subsoil ranges from sandy clay loam to light silty clay loam; colors range from hues of 7.5YR to 5YR. The substratum is generally at a depth of 18 to 24 inches, and the underlying outwash material is 15 to 30 feet thick.

Because the coarse-textured substratum is at a moderate depth, the Conotton soils are droughty at times. Their capacity for holding moisture available for plants is only moderate. Permeability is moderately rapid to rapid, and the leaching of plant nutrients is moderate. Internal drainage is rapid.

Conotton gravelly loam, 0 to 3 percent slopes (CtA).—The profile of this soil is similar to the one described as typical for the series. Included are small areas of moderately eroded soils.

Corn, small grains, potatoes, and most other crops grow well on Conotton gravelly loam, 0 to 3 percent slopes. The cobbles and large pebbles on the surface, however, may interfere with the planting of corn and small grains. The soil is also suited to hay and pasture. Crops need to be rotated, and cover crops ought to be grown to protect and improve the soil. Runoff and the hazard of erosion are slight. To increase yields, apply lime and fertilizer according to the needs indicated by soil tests. Irrigation could be used to good advantage on this soil. (Capability unit IIs–1; woodland suitability group 1.)

Conotton gravelly loam, 3 to 8 percent slopes (CtB).—This soil is on irregular, long, gentle slopes. Its profile is similar to the one described as typical of the series. Included are some moderately eroded areas that have a lighter colored surface layer.

Conotton gravelly loam, 3 to 8 percent slopes, is well suited to all crops grown locally. Dry weather reduces yields because of the lack of moisture. Consequently, irrigation can be used to good advantage, as the soil is near large streams. Cover crops are needed to prevent crusting, and they also keep the surface porous and prevent erosion. In addition, a source of organic matter is needed to replenish that which is lost through rapid aeration. Lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit IIe–1; woodland suitability group 1.)

Conotton gravelly loam, 15 to 25 percent slopes (CtD).—This soil is shallower than most of the soils in this series. Runoff is greater, and the soil is more droughty than Conotton gravelly loam, 0 to 3 percent slopes. The profile contains more pebbles and cobbles than the one described as typical for the Conotton series. Included are moderately eroded areas and areas in which slopes are 8 to 15 percent.

Conotton gravelly loam, 15 to 25 percent slopes, is better suited to pasture and hay than to cultivated crops, but it can be cultivated occasionally if management is good. Runoff and erosion are moderate hazards, but they can be controlled through the use of diversion terraces. (Capability unit IVe–1; woodland suitability group 2.)

Dekalb Series

The Dekalb series consists mainly of stony, steep, mountainous soils that have formed in shallow to moderately deep frost-worked material. These are the chief soils on steep mountain slopes in the county. They are well drained and have a yellowish-brown, medium-textured subsoil. The parent material was derived mostly from acid, gray sandstone. Some Dekalb soils are nearly level, but most areas are strongly sloping and are underlain by dipping bedrock. These areas are visible from a distance.

The original vegetation on these soils was black, chestnut, scrub, and white oaks mixed with some white and pitch pines. The present woodlands consist mainly of scrub and chestnut oaks. Nearly all areas of Dekalb soils are wooded.

The Dekalb soils are shallower than the deep, well-drained Hazleton soils. They are better drained than the moderately well drained Drifton soils and the somewhat poorly drained Alvira soils. The Dekalb soils are much better drained than the poorly drained Shelmadine soils and the very poorly drained Lickdale and Tughill soils. These soils occur together in many areas. They have all formed from parent material similar to that of the Dekalb soils.

The Dekalb soils are similar to the Lordstown soils, but they have a slightly browner, lighter textured subsoil. Their parent material also contained more material from sandstone and less from siltstone.

Typical profile (Dekalb very stony loam, 25 to 100 percent slopes, wooded):

A_{00} 4 to 2 inches of leaf litter from hardwoods.

A_0 2 inches to 0, black (10YR 2/1), fibrous leaf mold containing fungus mycelium; very strongly acid (pH 4.6).

A_1 0 to 4 inches, dark-brown (10YR 4/3) stony loam; 20 percent of mass is stones up to 10 feet in diameter; weak, fine, granular structure; friable; numerous roots; extremely acid (pH 4.4); clear, wavy lower boundary; layer ranges from 3 to 5 inches in thickness within a distance of a few feet.

A_2 4 to 10 inches, dark yellowish-brown (10YR 4/4 or 4/6) loam; 20 percent of mass is course fragments up to 10 feet in diameter; weak, fine and medium, granular structure; friable when moist; numerous roots; very strongly acid (pH 4.9); gradual, wavy lower boundary; layer ranges from 4 to 8 inches in thickness within a distance of a few feet.

A_3 10 to 16 inches, yellowish-brown (10YR 5/4), heavy loam; 20 percent of mass is course fragments up to 5 feet in diameter; weak, fine and medium, subangular blocky structure; thin clay films on stones; friable when moist; some roots; very strongly acid (pH 5.0); gradual, wavy lower boundary; layer ranges from 4 to 8 inches in thickness within a distance of a few feet.

B_3 16 to 25 inches, light yellowish-brown (10YR 6/4), heavy loam; 20 percent of mass is coarse fragments up to 5 feet in diameter; weak, fine and medium, subangular blocky structure; thin, discontinuous clay films on peds; friable when moist, slightly sticky when wet; some roots; very strongly acid (pH 4.8); gradual, wavy lower boundary; layer ranges from 7 to 11 inches in thickness within a distance of a few feet.

C 25 to 36 inches, yellowish-brown (10YR 5/4) loam; 20 percent of mass is coarse fragments up to 5 feet in diameter; weak, fine and medium, subangular blocky structure; thin clay films on stones; friable when moist, sticky when wet; few roots; very strongly acid (pH 4.8); clear, wavy lower boundary; layer ranges from 9 to 16 inches in thickness within a distance of a few feet.

D 36 inches +, bedrock.

The texture of the surface layer in the Dekalb soils ranges from channery silt loam to extremely stony loam. There are outcrops of bedrock on some steep slopes. In most places the B horizon is loam, but the texture ranges from loamy sand to silt loam. The colors in the C horizon are mainly hues of 10YR, but they range to 5YR. The Dekalb soils are generally between 16 and 30 inches thick. Bedrock is at a depth of 0 to 36 inches.

Dekalb soils are moderately low in capacity to hold available moisture. They are moderately rapid in permeability and are very strongly acid. Many areas have been burned over several times. As a result, the A_{00} and A_0 horizons are lacking or have been replaced by a very thin layer that consists partly of charcoal.

Dekalb very stony loam, 0 to 8 percent slopes (DeB).—This soil has a profile that is similar to the one described as typical of the Dekalb series. The profile, however, contains stones that are as much as 4 feet in diameter. Included are some small areas of channery silt loam.

Dekalb very stony loam, 0 to 8 percent slopes, has moderately rapid permeability and internal drainage. It is best kept in pasture or trees. If well managed and protected, the trees will produce wood products, protect the watershed, and provide habitats for wildlife. (Capability unit VIs–2; woodland suitability group 6.)

Dekalb very stony loam, 8 to 25 percent slopes (DeD).—The profile of this soil is like the one described as typical for the Dekalb series. Included are some channery areas in which there are only a few stones in the profile.

Dekalb very stony loam, 8 to 25 percent slopes, is mostly in areas that are higher than the surrounding land. It is too stony for cultivation. Permeability and internal drainage are rapid.

This soil is better used for pasture, trees, and wildlife areas than for other purposes. Fire lanes should be constructed to protect the woodlands and to provide open areas for wildlife. Other management is needed to improve the composition and productivity of the woodlands. (Capability unit VIs–2; woodland suitability group 7.)

Dekalb very stony loam, 25 to 100 percent slopes (DeF).—The profile of this soil is like the one described as typical for the Dekalb series. The soil is mainly on the slopes of mountains and is wooded. It is too steep and stony for cultivated crops or for improved pasture. Permeability and internal drainage are rapid. Erosion is a hazard in logged or burned-over areas.

This soil is better kept in trees or used as wildlife or recreational areas than for other purposes. The vegetation helps protect the watershed. The present woodlands consist mainly of undesirable kinds of trees in poor form or condition. Yields and rates of growth can be improved by protecting the areas from fire. This can be done by constructing roads and fire lanes. (Capability unit VIIs–3; woodland suitability group 8.)

Drifton Series

The Drifton series consists of medium-textured, moderately well drained soils that have a yellowish-brown surface layer and subsoil. Mottles are in the layer next to the hardpan, which is generally at a depth of about 24 inches. The soils have formed from deep, acid glacial till. The till consists of material derived from grayish sandstone with some shale and siltstone. The Drifton soils are on broad, level uplands and in lower positions on long, gentle slopes. The areas are mainly on Broad Mountain and in the mountainous areas of Penn Forest Township.

The natural vegetation on these soils consisted of white pine and hemlock mixed with red and white oaks. The present woodlands consist mainly of red maple, gray birch, pitch pine, red, white, and scrub oaks, sassafras, sheep laurel, aspen, and huckleberry.

The Drifton soils are less well drained than the Hazleton soils, but they are better drained than the Alvira, the Shelmadine, the Lickdale, and the Tughill. In many places Drifton soils are near all of these soils. The parent material of these soils is similar. Drifton soils are similar in color to the Comly soils, but they are coarser textured and have a thicker solum.

Typical profile (Drifton very stony loam on a slope of 3 percent in an undisturbed wooded area):

A_0 1 inch to 0, black decomposed leaf litter with some charcoal; extremely acid (pH 4.3).

A_1 0 to 2 inches, black (10YR 2/1) stony loam, high in organic matter; 10 percent of mass is rounded stones up to 18 inches in diameter; weak, fine, granular structure; friable when moist; many roots; very strongly acid (pH 4.6); clear, wavy lower boundary; layer ranges from 2 to 3 inches in thickness within a distance of a few feet.

A_2 2 to 8 inches, yellowish-brown (10YR 5/5) loam; 10 percent of mass is rounded stones up to 18 inches in diameter; weak, thin, platy structure; friable when moist; many roots; very strongly acid (pH 4.8); clear, wavy lower boundary; layer ranges from 6 to 8 inches in thickness within a distance of a few feet.

B_1 8 to 13 inches, yellowish-brown (10YR 5/6) loam; 15 percent of mass is rounded stones up to 12 inches in diameter; weak, medium, subangular blocky structure; friable when moist; some roots; strongly acid (pH

5.2); gradual, wavy lower boundary; layer ranges from 3 to 6 inches in thickness within a distance of a few feet.

B_{21} 13 to 19 inches, yellowish-brown (10YR 5/6) silt loam; 20 percent of mass is rounded stones up to 10 inches in diameter; weak, fine and medium, blocky structure; thin, discontinuous clay films on peds; friable when moist, slightly plastic when wet; some roots; strongly acid (pH 5.2); clear, wavy lower boundary; layer ranges from 5 to 8 inches in thickness within a distance of a few feet.

B_{22g} 19 to 27 inches, yellowish-brown (10YR 5/6) gravelly loam; common, fine, and distinct mottles of pale brown (10YR 6/3) and brownish yellow (10YR 6/8); 25 percent of mass consists of rounded stones up to 10 inches in diameter; weak, very coarse prisms with moderate, medium, blocky structure; thick, discontinuous clay films on peds; firm when moist, slightly plastic when wet; few roots; strongly acid (pH 5.2); clear, wavy lower boundary; layer ranges from 7 to 9 inches in thickness within a distance of a few feet.

B_{3g} 27 to 33 inches, yellowish-brown (10YR 5/4) gravelly loam; common, fine, faint mottles of pale brown (10YR 6/3) and brownish yellow (10YR 6/8); 30 percent of mass is rounded stones up to 8 inches in diameter; weak, very coarse prisms with weak, medium, blocky structure tending to platiness; thin, discontinuous clay films on peds; firm when moist; strongly acid (pH 5.3); abrupt, wavy lower boundary; layer ranges from 5 to 7 inches in thickness within a distance of a few feet.

C_{1g} 33 to 40 inches, yellowish-brown (10YR 5/8) gravelly loam; few, fine, faint mottles; 30 percent of mass is rounded stones up to 10 inches in diameter; firm when moist; strongly acid (pH 5.3).

Drifton soils have hues of 2.5Y to 7.5YR, but the hue is generally 10YR. The texture of the surface layer is loam or silt loam, and in places the stony areas are extremely stony. The texture of the subsoil is mostly gravelly loam, but in some areas it is silty clay loam. In some places a layer of dark grayish-brown (10YR 4/2) loam, ¼ to ½ inch thick, lies on top of the A_2 layer. In a few places the soil is less than 36 inches thick over bedrock, but in other places it is as much as 25 feet thick. A weak fragipan is at a depth of 18 to 30 inches .

Permeability of the compact layer is moderately slow. Internal drainage and the leaching of plant nutrients are moderately slow. The Drifton soils are strongly acid and are moderate in available moisture-holding capacity.

Drifton loam, 0 to 3 percent slopes (DrA).—The profile of this soil is similar to the one described as typical for the Drifton series. In areas that have been cultivated, however, the plow layer is dark brown and is 6 to 7 inches thick. In addition, there are few or no stones in wooded areas. Included are a few small areas of poorly drained soils in shallow potholes and a few moderately eroded areas.

Some of Drifton loam, 0 to 3 percent slopes, has been cleared and is farmed, but most of it is wooded. The soil is suited to most crops grown in the county, but it is not suited to deep-rooted crops. Because of the short growing season, oats, spinach, and other cool-season crops are the best to grow. Erosion is a slight problem on cropland. Diversion terraces are needed to control runoff and remove excess water. In addition, winter cover crops should be grown, and cultivating ought to be done on the contour. Subsurface drainage is needed to dry up wet spots. To obtain maximum crop yields, apply lime and fertilizer according to the needs indicated by soil tests.

Fire lanes are needed to protect the woodlands from fire. Thinning and improvement cuttings to remove the diseased, deformed, and less valuable trees are needed to improve the composition and productivity of the woodlands. (Capability unit IIw–2; woodland suitability group 3.)

Drifton loam, 3 to 8 percent slopes, moderately eroded (DrB2).—The profile of this soil is similar to the one described as typical for the series. In areas that have been cultivated, however, the plow layer is very dark brown and is 6 to 8 inches thick. In addition, there are a few or no stones in wooded areas. Included are a few stony areas.

Drifton loam, 3 to 8 percent slopes, moderately eroded, is better suited to oats, spinach, and other cool-season crops than to other crops. Diversion terraces and random closed drains are needed to drain moisture from fields used for potatoes, alfalfa, and other crops that cannot tolerate excess moisture. Graded striperopping and winter cover crops are need to help control erosion and improve soil tilth. To increase yields, apply lime and fertilizer according to the needs indicated by soil tests. (Capability unit IIe–4; woodland suitability group 3.)

Drifton very stony loam, 0 to 8 percent slopes (DsB).—This is the most extensive soil of the series. Its profile is similar to the one described as typical for the Drifton series. The surface layer ranges from stony to extremely stony, and there are stone stripes in many areas. Included are a few small areas of very poorly drained soils in glacial potholes.

Drifton very stony loam, 0 to 8 percent slopes, may be used for pasture or trees. Wooded areas should be protected from recurring fires by constructing fire lanes. Burned-over woodlands need this protection most.

Thinning the trees, removing diseased, crooked, and poor species, and practicing other good management will improve the composition and productivity of the woodlands. (Capability unit VIs–3; woodland suitability group 3.)

Fleetwood Series

The Fleetwood series consists of deep, well-drained soils that are strongly acid. The soils have a thin, black surface layer that overlies a thin, gray mineral layer. Below this, to a depth of 30 to 36 inches, is dark yellowish-brown to yellowish-brown sandy loam or sandy clay loam.

In undisturbed wooded areas, the thin, gray mineral layer overlies a thin, brownish or reddish layer. These upper layers are underlain by a layer of dark yellowish-brown to yellowish-brown sandy loam to sandy clay loam. In disturbed or cultivated areas, the layers that were formerly in the upper part of the profile have been mixed. The present plow layer is grayish brown and is 4 to 6 inches thick over the yellowish-brown, heavy subsoil.

The Fleetwood soils have formed in coarse-textured, frost-worked material consisting mostly of materials that weathered from quartzite. They are on moderate to strong slopes in the vicinity of the coalfields and are also along Stony Ridge.

Soils of the Fleetwood series are in positions above the moderately well drained to somewhat poorly drained Natalie soils and the poorly drained Andover soils. The

soils in these series have formed from similar parent material.

The Fleetwood soils have developed under a native forest consisting mainly of different kinds of oaks. Present woodlands consist of oak, red maple, sassafras, and aspen. In many areas that have been burned over recently, scrub oak is the main species.

Typical profile (Fleetwood very stony sandy loam on a slope of 10 percent, wooded):

- A_0 1 inch to 0, black organic layer of decomposed leaf litter; clear, broken lower boundary; layer ranges from 0 to 1½ inches in thickness within a distance of a few feet.
- A_1 0 to 1½ inches, black (N 2/0) sandy loam; light-gray sand grains and numerous stones up to 20 inches in diameter; weak, fine to medium, granular structure; very friable when moist; many roots; extremely acid (pH 4.0); abrupt, broken lower boundary; layer ranges from 0 to 2 inches in thickness within a distance of a few feet.
- A_2 1½ to 4 inches, gray (10YR 6/1) loamy sand; weak, very fine, subangular blocky structure; very friable when moist; some roots; very strongly acid (pH 4.6); clear, broken lower boundary; layer ranges from 0 to 5 inches in thickness within a distance of a few feet.
- B_1 4 to 6 inches, dark yellowish-brown to yellowish-brown (10YR 4/4 to 10YR 5/4) sandy loam; weak, very fine, subangular blocky structure; friable when moist, nonsticky when wet; numerous roots; extremely acid (pH 4.4); clear, wavy lower boundary; layer ranges from 1 to 3 inches in thickness within a distance of a few feet.
- B_2 6 to 10 inches, yellowish-brown (10YR 5/6) sandy clay loam; 25 percent of mass is gravel; weak, fine to medium, subangular blocky structure; friable when moist, slightly sticky when wet; numerous roots; very strongly acid (pH 4.6); clear, irregular lower boundary; layer ranges from 3 to 10 inches in thickness within a distance of a few feet.
- A'_2 10 to 17 inches, brownish-yellow (10YR 6/6) coarse sandy loam in upper part grading to yellowish brown (10YR 5/6) in lower part; 60 percent of mass is gravel; weak, medium, blocky structure; very friable when moist, slightly firm in place; few roots; very strongly acid (pH 4.6); clear, wavy lower boundary; layer ranges from 5 to 9 inches in thickness within a distance of only a few feet.
- B'_2 17 to 34 inches, yellowish-brown (10YR 5/5) coarse sandy clay loam; 40 percent of mass is gravel; moderate, very fine to fine, subangular blocky structure tending to medium platiness; thick and thin clay films on peds and in pores; friable when moist, slightly sticky when wet; few, fine roots; very strongly acid (pH 4.7); clear, irregular lower boundary; layer ranges from 10 to 22 inches in thickness within a distance of a few feet.
- C_1 34 inches +, coarse loamy sand.

The B_2 horizon in this podzol profile is generally at a depth of 6 to 10 inches, but the depth ranges from 4 to 12 inches. In some places a B_{1r} horizon, which ranges from a thin line to 3 or 4 inches in thickness, is present under the A_2 layer. In burned-over areas, the A_0 and A_1 horizons have been destroyed, and the present surface layer is thin and black and contains much charcoal. Bedrock is at a depth of 3 to 10 feet. The hues of these soils are commonly 7.5YR to 10YR. In areas along Stony Ridge, however, they range to 5YR because of the influence of the adjacent red beds. In this location the texture, structure, and consistence of these soils differ from those in the profile described as typical of the series. The subsoil also contains more clay and is more sticky and is slightly plastic in places. Clay films are more prominent, and the structure is blockier. In places the texture of the subsoil is loam.

In some places material high in iron has accumulated below the A_2 horizon. This material ranges from only a thin line to as much as 4 inches in thickness.

In the shallow Fleetwood soils, bedrock is at a depth of 3 feet or less. Also, the A_2 layer is thicker, as a rule, than that in the profile described, and the subsoil is thinner and lighter textured.

Except where they have been limed, the Fleetwood soils are very strongly acid. Permeability is rapid to moderately rapid, and the available moisture-holding capacity is moderate to low. Leaching of plant nutrients is moderately rapid to rapid.

Fleetwood sandy loam, 0 to 3 percent slopes (FtA).—This soil has a very dark brown surface layer that contains a few channery fragments in places. Otherwise, its profile is similar to the one described as typical for the Fleetwood series. The acreage is small; most of it is near Little Gap.

This soil has moderately rapid permeability and is moderate in available moisture-holding capacity. Organic matter is lost fairly rapidly because the soil is loose and well aerated.

This soil is well suited to most crops grown locally. Contour farming and winter cover crops are needed to control erosion. To improve crop yields, apply lime and fertilizer according to the needs indicated by soil tests. (Capability unit I–2; woodland suitability group 1.)

Fleetwood sandy loam, 3 to 8 percent slopes, moderately eroded (FtB2).—This soil is along Stony Ridge. The plow layer is very dark grayish brown, and in places it contains channery fragments. Otherwise, the profile is similar to the one described as typical for the Fleetwood series

Permeability and internal drainage are moderately rapid in this soil. The capacity for holding available moisture is moderate. Erosion is somewhat of a hazard on the steeper slopes.

This soil is suited to all the crops grown locally. Occasionally, however, the surface layer dries out to the extent that seeds do not germinate and young plants fail to grow. Diversion terraces, stripcropping, and cover crops are needed to conserve soil and moisture. Lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit IIe–1; woodland suitability group 1.)

Fleetwood sandy loam, 8 to 15 percent slopes, moderately eroded (FtC2).—This soil is not stony. It has a dark-brown surface layer. Otherwise, its profile is similar to the one described as typical for the Fleetwood series. Included are some channery areas that slightly hinder the planting of crops.

Because of the strong slopes and the light texture of the surface layer, erosion is a hazard on Fleetwood sandy loam, 8 to 15 percent slopes, moderately eroded. Internal drainage and permeability are both moderately rapid and the capacity to hold available moisture is moderate. Leaching of plant nutrients and the loss of organic matter are fairly rapid.

If well managed, this soil is suited to most crops commonly grown in the county. Diversion terraces should be used to conserve soil and moisture, as well as contour stripcropping, cover crops, and a cropping system that includes 2 or 3 years of hay. Crop residues ought to be left on the surface as a source of organic matter and to

increase the ability of the soil to absorb moisture. (Capability unit IIIe–1; woodland suitability group 2.)

Fleetwood very stony loam, shallow, 0 to 8 percent slopes (FvB).—This soil is shallow to moderately thick. Bedrock is at a depth of less than 3 feet. The A_2 layer is gray and is as much as 6 inches thick. It is commonly underlain by a dark-brown B_{1r} layer. Below a depth of 15 to 20 inches is the parent material of loamy sand that grades to loose conglomerate and hard sandstone. In places the bedrock is near the surface or is exposed. Apart from these features and a stonier surface layer, the profile of this soil is similar to the one described as typical for the Fleetwood series. Included are areas of deep soils that were too small to map separately.

Fleetwood very stony loam, shallow, 0 to 8 percent slopes, is very low in available moisture-holding capacity, and it has rapid permeability and internal drainage. The soil is in trees and should be kept in trees or pasture. The trees in the woodlands are mainly inferior scrub oak, chestnut oak, and gray birch. Because of the lack of moisture, the trees grow slowly, but they protect the watershed if they are properly managed. The woodlands need protection from fire. (Capability unit VIs–2; woodland suitability group 9.)

Fleetwood very stony loam, shallow, 8 to 25 percent slopes (FvD).—Except for slope, this soil is similar to Fleetwood very stony loam, shallow, 0 to 8 percent slopes. Included are rock outcrops and deep soils in areas too small to map separately.

Fleetwood very stony loam, shallow, 8 to 25 percent slopes, is suited to pasture or trees; the vegetation helps to protect the watershed. The main trees are scrub oak, chestnut oak, and gray birch. Trees grow slowly because of the lack of moisture. Fire prevention is the most important need in the woodlands. (Capability unit VIs–2; woodland suitability group 10.)

Fleetwood very stony loam, shallow, 25 to 100 percent slopes (FvF).—This soil is similar to the other shallow Fleetwood soils. Where it occurs at the bases of slopes, however, the profile is thicker as the result of soil creep. Where this soil is on steeper slopes, the profile is thinner over bedrock. Included are areas of rock outcrops.

Fleetwood very stony loam, shallow, 25 to 100 percent slopes, is better suited to trees than to pasture or field crops, and the vegetation helps to protect the watershed. The woodlands need to be protected from fire. (Capability unit VIIs–3; woodland suitability group 11.)

Fleetwood very stony sandy loam, 0 to 8 percent slopes (FwB).—The profile of this soil is like the one described as typical for the series, except that the surface has more stones, and the subsoil is slightly firmer. Most of this soil is near coalfields, and the timber on it has been cut heavily for mine props. The woodlands have been burned repeatedly to encourage the growth of blueberries.

Because it is stony, this soil is better suited to pasture or trees than to field crops. Most of the woodlands consist of scrub oak and other poor species of trees. The few stands of mixed oak and red maple need to be thinned and harvested selectively. Fire prevention is also needed. (Capability unit VIs–1; woodland suitability group 1.)

Fleetwood very stony sandy loam, 8 to 25 percent slopes (FwD).—The profile of this soil is similar to the one described as typical of the Fleetwood series. This soil is too stony to be plowed and is better used for pasture or trees. At the site where the sample for the typical profile was taken, oak trees 30 years of age were growing fairly rapidly on a north slope. Many areas have been burned over. Some were burned over to encourage the growth of blueberries.

The prevention of fire is the greatest management need in the woodlands. In some of the good stands, the trees need to be thinned and mature trees should be harvested. Oak grows well on this soil. (Capability unit VIs–1; woodland suitability group 2.)

Hartleton Series

The Hartleton series consists of well-drained, fine- to medium-textured soils that have a dark-brown surface layer and a yellowish-brown subsoil. These soils have formed in deep glacial till consisting of material from acid, gray shale, fine sandstone, and siltstone. They are on wide ridges and on the lower parts of slopes in the area between the mountain range above Packerton and Blue Mountain.

Hartleton soils are associated with the shallow Montevallo, the moderately well drained to somewhat poorly drained Comly, and the poorly drained Shelmadine soils. The soils of all these series have developed from similar parent material. In topographic position, the Hartleton soils are between the Montevallo and Comly soils.

Most areas of these soils have been cleared and are farmed. The native vegetation consisted of oak and white pine, but some of the present woodlands consist of white pine, red oak, and red maple.

Typical profile (Hartleton channery silt loam on a slope of 10 percent, moderately eroded):

A_p 0 to 8 inches, dark-brown (10YR 4/3) channery silt loam; 20 percent of mass is coarse fragments up to 3 inches in diameter; weak, fine, granular structure; friable when moist; many roots; neutral (pH 6.8); abrupt, smooth lower boundary; layer ranges from 6 to 9 inches in thickness within a distance of a few feet.

B_1 8 to 13 inches, yellowish-brown (10YR 5/6) channery loam; 25 percent of mass is coarse fragments up to 3 inches in diameter; very weak, medium, platy structure; friable when moist; some roots; moderately acid (pH 5.8); gradual, irregular lower boundary; layer ranges from 2 to 8 inches in thickness within a distance of a few feet.

B_{21} 13 to 20 inches, yellowish-brown (10YR 5/8) channery loam; 30 percent of mass is coarse fragments up to 3 inches in diameter; weak, medium, platy structure; thin, discontinuous clay films on peds; friable when moist; some roots; fine and medium lenses made up of about 90 percent gravel as much as 1 inch in diameter; moderately acid (pH 5.6); gradual, wavy lower boundary; layer ranges from 5 to 9 inches in thickness within a distance of a few feet.

B_{22} 20 to 28 inches, yellowish-brown (10YR 5/8) channery loam; 30 percent of mass is coarse fragments up to 3 inches in diameter; weak, medium, platy structure; thin, discontinuous clay films on peds; friable when moist; some roots; fine and medium lenses; strongly acid (pH 5.4); gradual, wavy lower boundary; layer ranges from 6 to 10 inches in thickness within a distance of a few feet.

B_3 28 to 32 inches, yellowish-brown (10YR 5/8) channery loam; 50 percent of mass is coarse fragments up to 6 inches in diameter; weak, thick, platy structure; thin, discontinuous clay films on peds; friable when moist; few roots; strongly acid (pH 5.2); gradual, irregular lower boundary; layer ranges from 3 to 6 inches in thickness within a distance of a few feet.

C_1 32 to 40 inches, yellowish-brown to brownish-yellow (10YR 5/8 to 6/8) channery loam; 60 percent of mass

is coarse fragments up to 6 inches in diameter; weak, thick, platy structure; friable when moist; strongly acid (pH 5.2); abrupt, irregular lower boundary; layer ranges from 4 to 12 inches in thickness within a distance of a few feet.

The texture of the surface layer in the Hartleton soils is generally channery silt loam or silt loam, but in a few places it is loam. In most places the subsoil is silt loam or fine sandy loam, but it is silty clay in some areas. In general, the coarse fragments range from channery to shaly, but they are gravelly in a few places. The soils are 4 to 8 feet thick over loose bedrock.

As a rule, these soils have weak platy or a subangular blocky structure; in a few places, however, the structure in the substratum is blocky. Platiness is caused by the layering of the fragments of shale. These soils are mainly yellowish brown (10YR), but there are also hues of reddish brown (5YR) and olive brown (2.5Y).

The Hartleton soils are moderately rapid in permeability and in internal drainage. Their available moisture-holding capacity is moderate. The soils are naturally strongly acid.

Hartleton channery silt loam, 0 to 3 percent slopes (HaA).—Approximately 10 to 20 percent of this soil is made up of shale and channery fragments, and the parent material is at a depth of 36 to 40 inches. Otherwise, the profile is similar to the one described as typical of the Hartleton series. Included are some moderately eroded areas and some in which the texture of the surface layer is silt loam.

Most areas of Hartleton channery silt loam, 0 to 3 percent slopes, have been limed, and in these areas the uppermost three or four horizons are neutral. Leaching of plant nutrients is moderate.

This soil is well suited to all of the crops commonly grown in the area. Contour farming and winter cover crops are needed to protect the soil from erosion. Lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit IIs–1; woodland suitability group 1.)

Hartleton channery silt loam, 3 to 8 percent slopes, moderately eroded (HaB2).—The profile of this soil is similar to the one described as typical for the series. Included are areas of slight or of no erosion. Also, north of the Lehigh Tunnel, an area is included that has a black surface layer 6 inches thick. In addition, there is an area in the southwestern corner of the county, near the Schuylkill County line, in which the subsoil has a texture of silty clay loam and contains fragments of chert.

Most of Hartleton channery silt loam, 3 to 8 percent slopes, moderately eroded, has been limed and is now only slightly acid in the upper layers. Leaching of plant nutrients is moderate, and there is a moderate hazard of erosion. Erosion can be controlled by growing crops in contour strips and by the use of cover crops and diversion terraces. This soil is well suited to all of the crops commonly grown, especially corn. To improve yields, apply lime and fertilizer according to the needs indicated by soil tests. (Capability unit IIe–3; woodland suitability group 1.)

Hartleton channery silt loam, 8 to 15 percent slopes, moderately eroded (HaC2).—The profile of this soil is similar to the one described as typical of the Hartleton series. Included is an area in the southwestern corner of the county that has fragments of chert in the subsoil.

Most areas of Hartleton channery silt loam, 8 to 15 percent slopes, moderately eroded, have been limed. In the areas that have been limed, the uppermost three horizons are now only slightly acid. The leaching of plant nutrients is moderate, and the hazard of erosion is serious. Diversion terraces, contour stripcropping, and grassed waterways are needed to hold moisture where it falls. Cover crops should be kept on the soil in winter.

This soil is suited to the crops grown in the county. To increase crop yields, apply lime and fertilizer according to the needs indicated by soil tests. (Capability unit IIIe–3; woodland suitability group 2.)

Hartleton channery silt loam, 8 to 15 percent slopes, severely eroded (HaC3).—The original surface layer of this soil has been lost through erosion, and the remaining soil is 24 to 30 inches thick. The present plow layer is yellowish brown (10YR 5/4) flecked with specks of brighter color. Otherwise, the profile of this soil is similar to the one described as typical for the series.

This soil has been limed, but, because of erosion and subsequent plowing of the subsoil, it is moderately acid. Leaching of plant nutrients is moderate. Losses through erosion have been more severe than on the soil described as typical of the series.

This soil is well suited to permanent hay or pasture. Diversion terraces are needed, in most places, to control runoff. Long slopes, intended for pasture, can be protected by seeding forage plants in contour strips. For best results, lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit IVe–2; woodland suitability group 2.)

Hartleton channery silt loam, 15 to 25 percent slopes, moderately eroded (HaD2).—The plow layer of this soil is yellowish brown, and about 30 percent of it consists of channery fragments. The B_1 layer is absent, but, otherwise, the profile is similar to the one described as typical of the Hartleton series.

Most of this soil is moderately to strongly acid, which indicates that more lime ought to be added. Erosion is a serious problem, and this soil receives a large amount of runoff from unprotected cropland. Pastures that have been grazed too closely and that have been compacted by the trampling of animals are also likely to be damaged severely by runoff and erosion.

This soil is better suited to permanent hay crops or pasture than to cultivated crops. Diversion terraces, strip seeding, and the rotation of pastures are needed to protect the soil. For best returns, apply lime and fertilizer according to the needs indicated by soil tests. (Capability unit IVe–2; woodland suitability group 2.)

Hartleton channery silt loam, 15 to 25 percent slopes, severely eroded (HaD3).—The surface layer of this soil is yellowish brown flecked with specks of a brighter color. Approximately 30 percent of the surface layer is made up of coarse fragments. The B_1 layer is absent, and the parent material is at a depth of about 24 inches. In these characteristics the profile of this soil differs from the one described as typical for the Hartleton series. In addition, this soil has thinner horizons. Included are small areas of rock outcrops and of Montevallo soils.

Runoff and erosion are severe hazards and limit the use of Hartleton channery silt loam, 15 to 25 percent slopes, severely eroded. Diversion terraces and grassed waterways are needed to protect the soil. Seeding of pasture should be done in contour strips. The soil is moderately

to strongly acid. Lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit VIe–2; woodland suitability group 2.)

Hartleton very stony loam, 0 to 8 percent slopes (HsB).—This soil has a very thin, black surface layer of very stony silt loam, and there are a few stones in the lower part of the profile. The stones consist of rounded pieces of cobbly sandstone or angular conglomerate, 6 to 48 inches in diameter. Below the surface layer, the profile of this soil is similar to the one described as typical for the Hartleton series.

This soil is too stony to cultivate, but it is suited to pasture and trees. White pine, red oak, and red maple grow well. To improve the woodlands, fire lanes should be provided, and mature trees thinned and harvested selectively. (Capability unit VIs–1; woodland suitability group 1.)

Hartleton very stony loam, 8 to 25 percent slopes (HsD).—The surface layer of this soil is similar to that of Hartleton very stony loam, 0 to 8 percent slopes. Below this, it has a profile like the one described as typical for the series.

This soil is too stony for cultivation, but it is suited to pasture, and trees grow well. The present woodlands consist of red oak, white oak, white pine, and red maple. Management should consist of establishing fire lanes and of thinning mature trees and harvesting them selectively. (Capability unit VIs–1; woodland suitability group 2.)

Hazleton Series

The Hazleton series consist of deep soils that have a yellowish-brown, mineral surface layer and a yellowish-brown to strong-brown subsoil. These colors reflect the good drainage and aeration that are typical of the Hazleton series.

The Hazleton soils are dominant on the long, moderate slopes of the Pocono highlands in Penn Forest Township. They are also dominant on similar slopes on Broad Mountain. These are the main agricultural soils near Albrightsville and Meckesville.

These soils have formed in material that weathered from pre-Wisconsin glacial till consisting of mixed sandstone, siltstone, and shale. Strong brown is the dominant color of the till, but in places it is yellow, yellowish red, or yellowish gray.

The native vegetation was mainly chestnut, white pine, and red and white oaks. Present hardwoods are mainly red, white, and scrub oaks, and red maple.

Hazleton soils have formed on parent material similar to that of the shallow to moderately deep Dekalb soils and the deep Drifton, Alvira, Shelmadine, Lickdale, and Tughill soils. In many areas the Hazleton soils occur near all of these soils.

The Hazleton soils are better drained than the moderately well drained Drifton, the somewhat poorly drained Alvira, the poorly drained Shelmadine, and the very poorly drained Lickdale and Tughill soils.

Typical profile (Hazleton very stony loam on a slope of 1 percent, wooded):

A_{00} 3 inches to 1 inch, hardwood leaf litter.

A_0 1 inch to 0, black (7.5YR 2/0), mor-type leaf mold with abundant fungus mycelia; extremely acid (pH 4.4); abrupt, wavy lower boundary; layer ranges from ½ to 1½ inches in thickness within a distance of a few feet.

A_1 0 to 3 inches, dark yellowish-brown (10YR 4/4) stony silt loam; 60 percent of mass is made up of pebbles and of stones up to 8 inches in diameter; weak, very fine, granular structure; friable when moist; many roots; very strongly acid (pH 4.6); abrupt, wavy lower boundary; layer ranges from 2 to 4 inches in thickness within a distance of a few feet.

A_2 3 to 7 inches, yellowish-brown (10YR 5/6) stony gravelly silt loam; 60 percent of mass is pebbles and stones up to 8 inches in diameter; weak, fine, granular structure to weak, thin, platy; friable when moist; many fine roots; very strongly acid (pH 4.8); clear, wavy lower boundary; layer ranges from 3 to 5 inches in thickness within a distance of a few feet.

A_3 7 to 11 inches, strong-brown (7.5YR 5/8) stony gravelly silt loam; 50 percent of mass is made up of pebbles and of stones up to 8 inches in diameter; weak, fine to medium, granular structure; friable when moist; many roots; strongly acid (pH 5.4); clear, wavy lower boundary; layer ranges from 3 to 5 inches in thickness within a distance of a few feet.

B_{21} 11 to 20 inches, yellowish-brown (10YR 5/6), gravelly, heavy silt loam; 35 percent of mass is made up of pebbles and of stones up to 8 inches in diameter; weak, fine and medium, subangular blocky structure; thin, discontinuous clay films on peds; friable when moist, slightly sticky when wet; many roots; very strongly acid (pH 5.0); gradual, wavy lower boundary; layer ranges from 7 to 12 inches in thickness within a distance of a few feet.

B_{22} 20 to 30 inches, yellowish-brown (10YR 5/8) gravelly silty clay loam; 35 percent of mass is made up of pebbles and of stones up to 8 inches in diameter; weak, fine to medium, subangular blocky structure; thin, discontinuous clay films on peds; hard when dry, friable when moist, moderately plastic when wet; medium acid (pH 5.6); gradual, wavy lower boundary; layer ranges from 7 to 13 inches in thickness within a distance of a few feet.

B_3 30 to 38 inches, yellowish-brown (10YR 5/8), gravelly, light silty clay loam; 35 percent of mass is made up of pebbles and of stones up to 8 inches in diameter; weak, medium, subangular blocky structure; few, thin clay films on peds; friable when moist, slightly plastic when wet; few roots; medium acid (pH 5.8); clear, wavy lower boundary; layer ranges from 5 to 11 inches in thickness within a distance of a few feet.

C_1 38 to 44 inches, strong-brown (7.5YR 5/8) stony sandy loam; 60 percent of mass is made up of gravel and of stones up to 8 inches in diameter; weak, medium and thin, platy structure; few, thin clay films on peds; friable when moist; strongly acid (pH 5.2).

The texture of the surface layer in the Hazleton soils is loam, silt loam, or sandy loam. In places it is stony, and in other places it is extremely stony or free of stones. Stone stripes are common in some places.

The texture of the subsoil in places is silty clay loam, and in other places it is silt loam, sandy clay loam, or fine sandy loam. The color of the subsoil ranges from hues of 10YR to 5YR. Depth to bedrock is commonly 10 feet, but it ranges from 6 to 25 feet. In some areas the regular profile overlies a buried horizon of clay loam.

The available moisture-holding capacity is high in these soils. Permeability and internal drainage are moderate. The soils are strongly acid. Leaching of plant nutrients is moderately slow.

Hazleton loam, 0 to 3 percent slopes (HtA).—Some areas of this soil have a very dark grayish-brown plow layer, and the wooded areas have undisturbed profiles. Both kinds of profiles are similar to the one described as typical of the Hazleton series, except that they are free of stones. Near Meckesville, these soils are lighter textured and show evidence of churning (*21*). In some nearly level areas north of Albrightsville, this soil is weakly mottled

and has a weak fragipan at a depth of 30 inches or more. The soil in these places grades to the Drifton soils. The fragipan does not affect cultivation or the growth of trees. In some places the soil has lost half the surface layer through erosion.

Hazleton loam, 0 to 3 percent slopes, is well suited to all of the crops grown in the county. It is especially well suited to potatoes, spinach, cabbage, and other cool-season crops. Farming on the contour, rotating crops, and growing winter cover crops are needed to protect the soil. The soil is very productive and responds well to management. Crops grown on it make good response if fertilizer is added. Lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit I–2; woodland suitability group 1.)

Hazleton loam, 3 to 8 percent slopes (HtB).—This soil is in trees and is relatively free of stones. Some areas have a heavier textured subsoil than that described in the typical Hazleton profile. In these places the soil approaches the heavy end of the range of the Hazleton series.

This soil is well suited to all of the crops grown in the county, especially to cool-season ones. It is also well suited to pasture and trees.

Cropping in contour strips and diverting runoff are needed to control erosion on this soil. The use of winter cover crops will help keep the surface soil permeable and protect it from erosion. Lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit IIe-1; woodland suitability group 1.)

Hazleton loam, 3 to 8 percent slopes, moderately eroded (HtB2).—This soil has a dark-brown to very dark grayish-brown plow layer. The profile is similar to the one described as typical of the Hazleton series, except that the surface layer is nearly free of stones. Included are a few lighter colored and severely eroded areas.

Hazleton loam, 3 to 8 percent slopes, moderately eroded, is suitable for all of the crops commonly grown in the county, especially the cool-season ones. It responds well to lime and fertilizer. Contour stripcropping is needed to control runoff from long slopes, and in places diversion terraces are required. The use of winter cover crops protects the soil from beating raindrops, runoff, and erosion. Lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit IIe–1; woodland suitability group 1.)

Hazleton loam, 8 to 15 percent slopes, moderately eroded (HtC2).—The profile of this soil is similar to the one described as typical for this series, except that it contains more sandy loam, and it may lack the A_3 and B_3 horizons. In depth to bedrock, it approaches the shallow limit of the Hazleton series. The surface layer is dark brown or dark yellowish brown.

This soil will erode easily if not protected. Diversion terraces, contour stripcropping, and cover crops are all needed to control runoff and erosion. Crop residue should be used as a surface mulch to add organic matter and improve the porosity of the soil.

This soil is suited to small grains, potatoes, and all crops grown locally. Lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit IIIe–1; woodland suitability group 2.)

Hazleton very stony loam, 0 to 8 percent slopes (HvB).—This soil occupies the largest acreage of any of the soils in the Hazleton series. The profile is like the one described as typical for the Hazleton series.

In most places the surface layer of Hazleton very stony loam, 0 to 8 percent slopes, contains too many stones to be tilled. This soil is suited to pasture and trees. Red and white oaks, white pine, and hemlock grow well. In the succession of plants on a site, white oak follows scrub oak. Therefore, many burned-over areas of this soil are covered by thick stands of white and scrub oaks. The woodlands should be protected and managed to provide future crops of timber. (Capability unit VIs–1; woodland suitability group 1.)

Hazleton very stony loam, 8 to 25 percent slopes (HvD)—The profile of this soil is similar to the one described as typical for this series, except that it is somewhat lighter textured and bedrock is at a depth of 6 to 10 feet.

This soil is suited to pasture and trees. Stones are too abundant and too large for it to be suited to cultivation. Red, black, and white oaks, red maple, and white pine are the trees that grow best. Fire prevention and good management are needed to improve the productivity of the woodlands. (Capability unit VIs–1; woodland suitability group 2.)

Holly Series

The Holly series consists of deep to moderately deep, poorly drained to somewhat poorly drained soils that are frequently flooded. The soils have a dark grayish-brown surface layer and a yellowish-brown to pale-brown subsoil. They have formed on flood plains from uniformly medium- to fine-textured sediments that were deposited by the floodwaters of slowly moving streams. Underlying these sediments, at a depth of 19 to 35 inches, is coarser textured material.

Holly soils are associated with the Tioga, the Middlebury, and the Papakating soils. All of these soils have formed from similar alluvial parent material. The Holly soils are less well drained than the Tioga and the Middlebury soils, but they are better drained than the Papakating. The Tioga soils are well drained; the Middlebury soils, moderately well drained; and the Papakating, very poorly drained.

The native vegetation on the Holly soils consisted of elm, pin oak, hemlock, and willow. Present woodlands have red maple in them.

Only one soil of this series, Holly silt loam, has been mapped in Carbon County.

Typical profile (Holly silt loam, level, in an idle field):

A_{p1} 0 to 4 inches, dark grayish-brown (10YR 4/2) silt loam; yellowish-brown (10YR 5/4) soil makes up 10 percent of layer; weak, fine, granular structure; slightly sticky and slightly plastic when wet; many roots; slightly acid (pH 6.2); clear, wavy lower boundary; layer ranges from 3 to 5 inches in thickness within a distance of a few feet.

A_{p2} 4 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; yellowish-brown (10YR 5/4) specks make up 5 percent of layer; weak to moderate, thin, platy structure breaks to moderate, fine, granular; slightly sticky and slightly plastic when wet; some roots; slightly acid (pH 6.2); abrupt, wavy lower boundary; layer ranges from 3 to 5 inches in thickness within a distance of a few feet.

C_{11g} 8 to 13 inches, brown to yellowish-brown (10YR 5/3 to 5/4) silt loam; few, fine, faint mottles; weak to moderate, medium, platy structure that breaks to

moderate, fine, blocky structure; 2 percent of surface coated with black (10YR 2/1) films of iron and manganese; slightly sticky and slightly plastic when wet; moderately acid (pH 5.6); gradual, irregular lower boundary; layer ranges from 3 to 6 inches in thickness within a distance of a few feet.

C_{12g} 13 to 19 inches, brown (10YR 5/3) silt loam; common, fine, and faint to distinct mottles of pale brown and yellowish brown (10YR 6/3 to 5/6); weak to moderate, medium, platy to blocky structure; 2 percent of surface coated with black (10YR 2/1) films of iron and manganese; thin, discontinuous clay films on peds; slightly sticky and slightly plastic when wet; moderately acid (pH 5.8); gradual, irregular lower boundary; layer ranges from 3 to 7 inches in thickness within a distance of a few feet.

C_{13g} 19 to 24 inches, pale-brown (10YR 6/3) loam; common, fine, and prominent mottles of strong brown (7.5YR 5/6) and yellowish brown to brownish yellow (10YR 5/6 to 6/6); weak, medium, platy to subangular blocky structure; 2 percent of surface coated with films of iron and manganese; slightly sticky when wet; moderately acid (pH 6.0); clear, wavy lower boundary; layer ranges from 4 to 6 inches in thickness within a distance of a few feet.

C_{14g} 24 inches +, yellowish-brown (10YR 5/4) sandy loam; few, fine, faint mottles; weak, thin, platy to blocky structure; 2 percent of surface coated with films of iron and manganese; moderately acid (pH 6.0).

The texture of the surface layer in the Holly soils ranges from silt loam to silty clay loam. The texture in the rest of the profile depends on the order in which the soil material was deposited. Colors range from hues of 7.5YR to 2.5Y; depth to sandy or gravelly material is generally 24 to 44 inches. In some areas the films of manganese and iron oxide are lacking.

Holly soils have very slow internal drainage and slow permeability. They are moderate in available moisture-holding capacity. Leaching of plant nutrients is very slow.

Holly silt loam (Hy).—The profile of this soil is like the one described as typical of the Holly series. Included are some areas in which the surface layer consists of a deposit of thick, dark grayish-brown sediment. Also included are areas of locally ponded sediment on Broad Mountain and undisturbed areas that have a thin, very dark grayish-brown surface horizon.

Holly silt loam is suited to locally grown, shallow-rooted crops if it is bedded or if another method of open drainage is used. Because it is wet and is flooded frequently, it is best suited to permanent hay or pasture. A seeding mixture, consisting of birdsfoot trefoil and reed canarygrass, is suited to the wet conditions. (Capability unit VIw–1; woodland suitability group 5.)

Klinesville Series

The Klinesville series consists of shallow, well-drained soils that have a reddish profile. As a rule, the soils consist of 6 to 18 inches of channery loam over shattered, reddish siltstone, fine sandstone, and shale.

These soils are on nearly level to steep slopes, mainly on the broad ridge crossing the county south of Lehighton and in the wide valley north of Broad Mountain. They have formed in other places in which red beds have outcropped.

Klinesville soils have formed in well-drained, frost-worked (5) parent material like that of the moderately deep Leck Kill soils; the deep, well drained Allenwood; the deep, moderately well drained Watson; and the somewhat poorly drained Alvira and Shelmadine soils. In places the Klinesville soils are on ridges and slopes above all of these soils. On Wire Ridge south of Lehighton, they occur mainly with the Leck Kill soils.

The native vegetation on the Klinesville soils was probably white pine and white and chestnut oaks. Many areas of Klinesville soils have been tilled, some are idle, and some have been planted to conifers. The present woodlands are mostly on steep slopes and consist of chestnut and white oaks, white pine, and hemlock on north-facing slopes. On the other slopes, chestnut and white oaks predominate.

Typical profile (Klinesville channery silt loam on a slope of 34 percent, severely eroded):

A_p 0 to 5 inches, dusky-red (2.5YR 3/2) channery silt loam; 25 percent of mass is coarse fragments; weak, fine, granular structure; friable when moist; slightly acid (pH 6.1); clear, wavy lower boundary; layer ranges from 3 to 7 inches in thickness within a distance of a few feet.

B_3 5 to 13 inches, weak-red to dusky-red (10R 4/4 to 3/4) channery silt loam; 30 percent of mass is coarse fragments; weak, fine, subangular blocky structure; thin, discontinuous clay films on peds; friable when moist; moderately acid (pH 5.6); clear, irregular lower boundary; layer ranges from 4 to 8 inches in thickness within a distance of a few feet.

C_1 13 to 20 inches, weak-red (10R 4/3) fragments, coated with silt and clay; 85 percent of mass is coarse fragments; friable when moist; moderately acid (pH 5.6); clear, irregular lower boundary; layer ranges from 1 to 10 inches in thickness within a distance of a few feet.

C_2 20 to 28 inches +, weak-red (10R 4/2) fragments coated with weak-red (10R 5/3) silt and clay; 98 percent of mass is coarse fragments up to 24 inches in diameter; moderately acid (pH 5.6).

The thickness of this soil varies because of differences in the resistance and folding of the bedrock. Klinesville soils range in thickness from 6 to 18 inches over loose bedrock. Solid bedrock generally is at a depth of 1 to 5 feet. Because of frost action during the last glacial period, the bedrock is shattered at these depths. The color of the soil ranges from hues of 10R to 2.5YR.

These soils have rapid permeability and very rapid internal drainage. Their available moisture-holding capacity is low. In unlimed areas the soils are strongly acid.

Klinesville channery silt loam, 3 to 8 percent slopes, moderately eroded (KcB2).—This soil is 14 to 18 inches thick over bedrock, and between 10 and 30 percent of the soil material consists of coarse fragments. Otherwise, the profile is similar to the one described as typical for the series. Included are shaly and gravelly areas; some areas of moderately deep Leck Kill soils; and slightly eroded or uneroded areas that are wooded.

Klinesville channery silt loam, 3 to 8 percent slopes, moderately eroded, is friable and is easily worked. Coarse fragments interfere slightly with the planting of drilled crops. Runoff is moderate, and there is a moderate hazard of erosion. The soil is droughty; good crops are grown only when moisture conditions are ideal. Contour stripcropping and the growing of winter cover crops are the practices most needed to conserve moisture. Lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit IIIe–4; woodland suitability group 9.)

Klinesville channery silt loam, 8 to 15 percent slopes, moderately eroded (KcC2).—This soil consists of 14 to 16 inches of channery silt loam over loose bedrock. It has lost about half of the original surface layer through

erosion. Otherwise, the profile is similar to the profile described as typical of the Klinesville series. Included are gravelly and shaly areas and slightly eroded or uneroded areas that are wooded.

Klinesville channery silt loam, 8 to 15 percent slopes, moderately eroded, is droughty and is not well suited to crops. Good yields are produced only when there is enough rainfall and when the rainfall is well distributed throughout the growing season. The coarse fragments interfere somewhat with the planting of drilled crops. Contour stripcropping, diversion terraces, and winter cover crops are needed to control runoff and hold moisture where it falls. A cropping system needs to be used that consists of 1 year each of corn, oats, and wheat followed by 2 or 3 years of hay. Lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit IVe–3; woodland suitability group 10.)

Klinesville channery silt loam, 8 to 15 percent slopes, severely eroded (KcC3).—This soil has lost all or nearly all of its original surface layer and is only 12 to 15 inches thick over loose bedrock. Otherwise, its profile is like the one described as typical of the Klinesville series.

This soil is suited mainly to permanent hay. It is too droughty in most years for tilled crops. Runoff from long slopes can be controlled by using diversion terraces. Fields intended for pasture or hay should be seeded in strips to help prevent erosion. Lime and fertilizer ought to be applied according to the needs indicated by soil tests. (Capability unit VIe–2; woodland suitability group 10.)

Klinesville channery silt loam, 15 to 25 percent slopes, moderately eroded (KcD2).—This soil has lost about half of its original surface layer through erosion. It now consists of 12 to 15 inches of channery silt loam over the parent material. The profile is similar to the one described as typical for the series, except that it contains a slightly smaller number of channery fragments. Included are slightly eroded or uneroded areas that are wooded.

Klinesville channery silt loam, 15 to 25 percent slopes, moderately eroded, is better suited to permanent hay or pasture than to tilled crops. Tilled crops should be grown only occasionally. The soil is suited to birdsfoot trefoil, which tolerates dryness. Diversion terraces are needed to control runoff and erosion. Fields intended for hay or pasture need to be seeded in contour strips to protect the soil. Lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit VIe–2; woodland suitability group 10.)

Klinesville channery silt loam, 15 to 25 percent slopes, severely eroded (KcD3).—The profile of this soil is like the one described as typical of the Klinesville series.

This soil is better suited to trees than to pasture or field crops. Fields to be planted in trees should be protected by diversion terraces. Pine, larch, and black locust are suitable for planting where natural seeding is inadequate or absent. Lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit VIIe–1; woodland suitability group 10.)

Klinesville channery silt loam, 25 to 35 percent slopes, moderately eroded (KcE2).—This soil is less eroded and has fewer coarse fragments in the surface layer than the one described as typical of the Klinesville series. Included are slightly eroded or uneroded areas that are wooded.

Forestry appears to be the best use for Klinesville channery silt loam, 25 to 35 percent slopes, moderately eroded. Larch, pine, and black locust are better suited to this soil than other kinds of trees because they tolerate dryness. They can be grown for products other than timber, which makes them desirable in the woodlands. (Capability unit VIIe–1; woodland suitability group 11.)

Klinesville channery silt loam, 25 to 35 percent slopes, severely eroded (KcE3).—The profile of this soil is like the one described as typical of the Klinesville series. Because of the nature of the folded bedrock and erosion, this soil is only 4 to 14 inches thick over the parent material.

This soil is better suited to trees than to pasture or field crops. Nevertheless, the trees grow slowly. Because the soil is shallow and droughty, it is better suited to pine, larch, and black locust than to other kinds of trees. (Capability unit VIIe–1; woodland suitability group 11.)

Klinesville channery silt loam, 35 to 80 percent slopes (KcF).—This soil has a thin, black surface layer and a thin, reddish-gray subsurface layer. Otherwise, its profile is similar to the profile described as typical of the Klinesville series. Bedrock is at a depth of 12 to 18 inches. Included are a few severely eroded areas that have been cleared, and there are outcrops and extremely stony areas.

Klinesville channery silt loam, 35 to 80 percent slopes, is better suited to trees or to wildlife areas than to other uses. Nearly all of it is now in trees, mainly hemlock, chestnut oak, and other minor species. Because of poor conditions on these steep, shallow soils, the trees grow slowly and yield only a small amount of merchantable timber. Fire should be prevented so that the vegetation can be managed for watershed protection. (Capability unit VIIe–1; woodland suitability group 11.)

Klinesville channery silt loam, 35 to 80 percent slopes, severely eroded (KcF3).—Most of this soil is in the lower part of the slope range. Some areas have been farmed and are now idle, or they have been planted to trees. Other areas have been logged destructively, or burned over and eroded.

This soil is better suited to trees or wildlife areas than to other uses. It is near streams, and, therefore, the vegetation should be managed to protect the watershed. Fires can be prevented through the use of firebreaks. (Capability unit VIIe–1; woodland suitability group 11.)

Klinesville very stony silt loam, 8 to 25 percent slopes (KvD).—The profile of this soil is similar to the typical profile described for the series, except that it has a stony, thin, black surface layer and a thin, reddish-gray subsurface layer. Stones in the soil are mainly conglomerate from higher lying formations.

This soil is mainly in the mountainous areas. It is too stony for cultivation and is suited only to pasture or trees. The trees are in poor condition because of destructive logging and frequent fires in the past. Providing fire lanes and using good management are the greatest needs of these areas. The areas should be managed carefully because of their value for wildlife and for protecting the watershed. (Capability unit VIs–2; woodland suitability group 10.)

Klinesville very stony silt loam, 25 to 80 percent slopes (KvF).—The profile of this soil is similar to the profile described as typical of the series, except that this soil has a thin, black surface layer and a thin, reddish-gray subsurface layer. The stones are from higher lying for-

mations. This soil is mostly on the lower part of steep mountain slopes, where the red beds dip under the mountains.

This soil is better suited to trees or to wildlife areas than to pasture or field crops, and the vegetation protects the watershed. The soil is too stony and steep for cultivated crops or pasture, and its suitability for the production of timber is only fair to moderate. The growth of the trees depends on the characteristics of the site. Protection from fire is needed more than other management practices. (Capability unit VIIs–3; woodland suitability group 11.)

Laidig Series

The Laidig series consists of deep, well-drained, yellowish-brown to reddish-yellow soils that have a hardpan at a depth of about 34 inches. The soils have formed on colluvial slopes at the bases of steep mountains. Their parent material was weathered from a mixture of gray and red sandstone, conglomerate, siltstone, and shale.

The parent material of the Laidig soils is similar to that of the moderately well drained Buchanan soils. In many places the Laidig soils occur above and near the Buchanan soils.

The Laidig soils developed under a cover of white pine, hemlock, mixed oaks, tulip-poplar, and black birch. The present woodlands contain many red maples.

Typical profile (Laidig very stony loam on a slope of 9 percent, in a wooded area):

A_0 1 inch to 0, black (5YR 2/1), greasy; mor; 60 percent of mass is stones and boulders up to 40 inches in diameter; many stones and boulders are on the surface; many roots; abrupt, smooth lower boundary; layer ranges from ½ inch to 1½ inches in thickness within a distance of a few feet.

A_1 0 to 2 inches, black (5YR 2/1) loam; 30 percent of mass is stones and boulders up to 30 inches in diameter; weak, very fine, granular structure; very friable when moist; many roots; very strongly acid (pH 4.7); abrupt, smooth lower boundary; layer ranges from 1½ to 2½ inches in thickness within a distance of a few feet.

A_2 2 to 4 inches, grayish-brown (10YR 5/2) loam; 20 percent of mass is made up of pebbles and of stones up to 9 inches in diameter; weak, very fine, granular structure; very friable when moist; some roots; strongly acid (pH 5.1); abrupt, irregular lower boundary; layer ranges from 1 to 3 inches in thickness within a distance of a few feet.

A_3 4 to 10 inches, yellowish-brown (10YR 5/6), heavy loam; 15 percent of the mass is coarse fragments up to 9 inches in diameter; weak, fine to medium, subangular blocky structure; friable when moist, slightly sticky when wet; some roots; strongly acid (pH 5.3); clear, wavy lower boundary; layer ranges from 4 to 8 inches in thickness within a distance of a few feet.

B_{21} 10 to 20 inches, brownish-yellow (10YR 6/8) sandy clay loam; 20 percent of the mass is coarse fragments up to 9 inches in diameter; moderate, fine, blocky structure with some platiness; thin, discontinuous clay films on peds; friable when moist, sticky when wet; few roots; strongly acid (pH 5.4); clear, wavy lower boundary; layer ranges from 8 to 13 inches in thickness within a distance of a few feet.

B_{22} 20 to 27 inches, brownish-yellow (10YR 6/6) sandy clay loam; 25 percent of mass is coarse fragments up to 6 inches in diameter; weak, thick, platy structure; thin, discontinuous clay films on peds; friable when moist, slightly sticky when wet; strongly acid (pH 5.3); clear, wavy lower boundary; layer ranges from 5 to 9 inches in thickness within a distance of a few feet.

C_1 27 to 60 inches +, yellowish-brown (10YR 5/6) sandy loam; 35 percent of mass is coarse fragments up to 6 inches in diameter; weak, fine, blocky structure with a tendency to massiveness; firm when moist, slightly sticky when wet; vertical lenses of loam and stone; strongly acid (pH 5.4).

The Laidig soils are extremely variable in color and texture and in depth, parent material, and other factors. Colors range from hues of 2.5YR to 10YR; textures are generally medium to coarse, but they range from loamy sand to clay loam.

The depth to bedrock is about 15 feet, but it ranges from 4 to 30 feet. In most places the parent material weathered from grayish sandstone and conglomerate. In some places, however, red siltstone and shale are the sources of the red color in the profile and of the greater proportion of fine-textured soil material. In many areas the colluvial material is underlain by stratified sand, silt, and clay from glacial deposits.

The available moisture-holding capacity of these soils is moderately high. Internal drainage is moderately rapid to the hardpan; permeability is moderately rapid in the upper part of the solum, but it is only moderate through the pan layer. The Laidig soils are naturally strongly acid.

Laidig gravelly loam, 3 to 8 percent slopes, moderately eroded (LaB2).—About half the original surface layer of this soil has been lost through erosion. The present surface layer is very dark grayish brown and is about 8 inches thick. Otherwise, the profile of this soil is similar to the one described as typical of the Laidig series. Included are severely eroded areas, which have lost all of the original surface layer through erosion. Also included are some moderately well drained soils in seepage areas.

Laidig gravelly loam, 3 to 8 percent slopes, moderately eroded, is suited to most crops grown locally. Because of its topographic position and the fragipan, which limits the intake of water, it must be well managed if it is cultivated. Diversion terraces and contour stripcropping are needed to control runoff and erosion. Winter cover crops will give additional protection. Lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit IIe–2; woodland suitability group 1.)

Laidig gravelly loam, 8 to 15 percent slopes, moderately eroded (LaC2).—More than half the original surface layer of this soil has been lost through erosion. The profile is similar to the one described as typical for the Laidig series, except that the plow layer is now a very dark grayish-brown gravelly loam. This layer replaces the A horizon of the typical profile. The stones have been picked off to allow tillage. Included with this soil in mapping are severely eroded areas and areas of moderately well drained soils in seepy spots.

If Laidig gravelly loam, 8 to 15 percent slopes, moderately eroded, is not protected, runoff and erosion may be severe. The hardpan, strong slopes, and the steep slopes above it make cultivation hazardous. Coarse fragments in the soil may interfere somewhat with tillage and seeding. Nevertheless, this soil is suited to corn, small grains, and hay, and to most of the other crops commonly grown.

Diversion terraces and stripcropping are needed to protect this soil from erosion. Closed drains can be used to eliminate the seepage areas. A cropping system in which hay is grown for at least 2 years helps to improve soil structure and tilth. Lime and fertilizer should be ap-

plied according to the needs indicated by soil tests and according to the crop to be grown. (Capability unit IIIe–2; woodland suitability group 2.)

Laidig gravelly loam, 15 to 25 percent slopes, severely eroded (LaD3).—This soil has lost nearly all of its original surface layer through erosion. The profile is similar to the one described as typical for the series, except that it contains more cobbles and pebbles and fewer stones. This soil is strongly sloping and adjoins mountains, streams, and drainageways. Runoff is greater than on the soil described as typical of the series, and permeability is slower.

This soil is better suited to pasture or trees than to cultivated crops. Diversion terraces are needed to control runoff and protect seeded fields. For pasture, birdsfoot trefoil or another long-term legume is preferable to a short-term legume. To improve the vigor of the plants and the yields of forage, apply lime and fertilizer according to the needs indicated by soil tests. (Capability unit VIe–1; woodland suitability group 2.)

Laidig very stony loam, 3 to 8 percent slopes (LdB).—The profile of this soil is similar to the one described as typical for the Laidig series. The soil is well drained and is near streams on the lower parts of colluvial slopes.

This soil is suited to pasture and trees. The present woodlands consist of mixed oaks, white pine, and hemlock. The needed management consists of thinning the trees, harvesting mature and crooked trees selectively, and building fire lanes. The woodlands should be managed to protect the watershed. (Capability unit VIs–1; woodland suitability group 1.)

Laidig very stony loam, 8 to 25 percent slopes (LdD).—This is the most extensive soil in the Laidig series. The profile is like the one described as typical for the Laidig series. Stone stripes are on most of the areas. In an area north of Blue Mountain, cryoplane terraces, formed as the result of periglacial frost action (*19*), run diagonally across the slope.

This soil is suited to pasture or trees, and nearly all of it is wooded. Some of the areas have been burned over, but some areas contain good stands of mixed oaks and white pine. Protecting the areas from fire and improving the stand will increase the future productivity of the woodlands. (Capability unit VIs-1; woodland suitability group 2.)

Leck Kill Series

The Leck Kill series consists of moderately deep, well-drained, medium-textured soils that have a dark reddish-brown to black surface layer and a brown to reddish-brown subsoil. The soils have formed from a mixture of reddish-brown siltstone, shale, and fine sandstone that has been reworked by glaciers. The bedrock underlying this material is mostly reddish brown, but in places it is weak red or dark red. The Leck Kill soils are mainly nearly level to strongly sloping; a few areas have irregular relief because of local differences in the resistance of the rock formations.

These soils have formed under a forest of white pine and mixed oaks. The present woodlands consist chiefly of chestnut and white oak mixed with white pine, gray birch, and sassafras.

Leck Kill soils are deeper than the Klinesville soils. They are shallower than the deep, well drained Allenwood and the moderately well drained Watson soils. All of these soils have formed from similar materials, and in many areas, particularly in Quakake Valley, they occur together.

Typical profile (Leck Kill channery silt loam, 3 to 8 percent slopes, moderately eroded, cultivated):

A_p 0 to 8 inches, dark-brown (7.5YR 3/2) channery silt loam; 30 percent of mass is coarse fragments up to 4 inches in length; weak, fine, granular structure; many roots; slightly acid (pH 6.2); abrupt, wavy lower boundary; layer ranges from 7 to 9 inches in thickness within a distance of a few feet.

B_1 8 to 13 inches, brown (7.5YR 5/3) channery silt loam; 15 percent of mass is coarse fragments up to 4 inches in length; weak, fine to medium, subangular blocky structure; friable; some roots; slightly acid (pH 6.1); gradual, wavy lower boundary; layer ranges from 4 to 7 inches in thickness within a distance of a few feet.

B_2 13 to 18 inches, reddish-brown (5YR 4/3), channery, heavy silt loam; 25 percent of mass is coarse fragments up to 4 inches in length; weak, medium, blocky structure; friable; few roots; medium acid (pH 5.6); gradual, wavy lower boundary; layer ranges from 5 to 9 inches in thickness within a distance of a few feet.

B_3 18 to 25 inches, reddish-brown (5YR 5/4) channery silt loam; 40 percent of mass is coarse fragments up to 4 inches in diameter; weak, fine to medium, blocky structure; friable; few roots; medium acid (pH 5.6); gradual, wavy lower boundary; layer ranges from 5 to 9 inches in thickness within a distance of a few feet.

C_1 25 to 32 inches, reddish-brown (5YR 5/4) very channery silt loam; 60 percent of mass is coarse fragments up to 5 inches in diameter; very weak, fine, blocky structure; friable; strongly acid (pH 5.2).

D_1 32 inches +, reddish-brown and olive siltstone; moderately hard, somewhat shattered.

The B and C horizons in the Leck Kill soils range in hue from 7.5YR to 2.5YR, and in texture, from gravelly or channery silt loam to gravelly or channery loam. The depth to the substratum of shattered bedrock ranges from 18 to 36 inches, and in most places it is about 30 inches. The depth varies within short distances because of the folding and varying resistance of the bedrock.

Permeability is moderately rapid to rapid. Except in areas that have been heavily limed, the soils are strongly acid throughout the profile. The available moisture-holding capacity is moderate to moderately low. Internal drainage is rapid; leaching of plant nutrients is fairly rapid.

Leck Kill channery silt loam, 0 to 3 percent slopes (LeA).—The profile of this soil is similar to the one described as typical for the Leck Kill series, but this soil is less eroded. This soil is on broad, flat ridgetops and in nearly level areas at the heads of natural gullies. The gullies have cut down through the soft shale bedrock. Included are areas in which the texture of the surface layer is gravelly silt loam. Also included are areas that are moderately eroded.

Leck Kill channery silt loam, 0 to 3 percent slopes, is suited to corn, small grains, and hay, and to all of the other crops grown in the area. Coarse fragments interfere somewhat with the seeding of drilled crops. In dry years the crops are damaged by lack of moisture.

Contour farming and winter cover crops are needed to conserve moisture and to add organic matter to this soil. Lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit IIs-1; woodland suitability group 6.)

Leck Kill channery silt loam, 3 to 8 percent slopes, moderately eroded (LeB2).—The profile of this soil is like the one described as typical for the series. This soil

is on gently sloping ridges and on side slopes that are somewhat dissected.

In areas that have been cultivated, this soil is eroded and the surface layer is now dark brown or reddish brown. In eroded areas the surface layer contains more coarse fragments of stone than are in the surface layer of the profile described as typical for the series. Included are some areas in which the texture of the surface layer is gravelly silt loam and areas of slight or of no erosion.

Leck Kill channery silt loam, 3 to 8 percent slopes, moderately eroded, will hold only a moderate amount of water that plants can use. Except in areas that have been limed, it is very strongly acid. Leaching of plant nutrients is rapid. The surface layer is very friable, but coarse fragments interfere somewhat with the seeding of small grains.

This soil is suited to all of the general crops commonly grown in the area. Yields are limited in many years by lack of moisture. Contour stripcropping, diversion terraces, and use of a cropping system that includes hay or pasture are needed to control runoff and erosion. Because the soil is well aerated, organic matter is depleted rapidly in cultivated areas. Cover crops that are grown after cultivated crops are harvested add to the supply of organic matter and help protect the soil from erosion. Lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit IIe–3; woodland suitability group 6.)

Leck Kill channery silt loam, 8 to 15 percent slopes, moderately eroded (LeC2).—The profile of this soil is similar to the one described as typical of the Leck Kill series, except that it is more channery throughout and the plow layer is dark brown.

This soil is suited to most crops grown in the county, but in dry years yields are limited. Channery and gravelly fragments interfere somewhat with the seeding of small grains.

Contour stripcropping, diversion terraces, and grassed waterways are needed to control runoff. Including winter cover crops and hay crops in the cropping system adds to the supply of organic matter, improves permeability, and protects the soil from erosion. Lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit IIIe–3; woodland suitability group 7.)

Leck Kill channery silt loam, 8 to 15 percent slopes, severely eroded (LeC3).—The profile of this soil is similar to the typical profile, except that it has a dark reddish-brown plow layer. This soil is also more eroded and is more channery throughout. Included are areas where the soil has formed partly in colluvium and contains pieces of gray, fine sandstone. These areas are in Beaver Creek Valley.

Because of the hazard of erosion, Leck Kill channery silt loam, 8 to 15 percent slopes, severely eroded, is better suited to permanent hay or pasture than to tilled crops. Tilled crops can be grown only at fairly long intervals. Diversion terraces and grassed waterways can be used to control runoff and protect seeded areas. Long slopes should be seeded in contour strips to protect the soil from erosion.

Most mixtures of hay and pasture plants are suited to this soil, but birdsfoot trefoil can withstand dry periods better than most plants. Lime and fertilizer should be applied according to the needs indicated by soil tests and according to the crop to be grown. (Capability unit IVe–2; woodland suitability group 7.)

Leck Kill channery silt loam, 15 to 25 percent slopes, moderately eroded (LeD2).—The profile of this soil is similar to the one described as typical for the series, except that it has a dark reddish-brown plow layer and is more channery. This soil has formed in materials that weathered from softer shale than the soil described, and it is in lower positions on slopes. Included are areas in which the soils have formed partly in colluvium and contain some gray, fine sandstone. The included areas are in Beaver Creek Valley.

Because of the strong slopes and the hazard of erosion, Leck Kill channery silt loam, 15 to 25 percent slopes, moderately eroded, is better suited to permanent hay or pasture than to tilled crops, but tilled crops can be grown occasionally. Diversion terraces are needed to control runoff. Pasture or meadow should be seeded to birdsfoot trefoil or other drought-resistant plants. Lime and fertilizer, applied according to the needs indicated by soil tests, will improve the yields of forage. (Capability unit IVe–2; woodland suitability group 7.)

Leck Kill channery silt loam, 15 to 25 percent slopes, severely eroded (LeD3).—The profile of this soil is similar to the typical one, except that it has a dark reddish-brown plow layer that has been mixed in tillage with the reddish-brown subsoil. Also, it is more channery, and the soil is more eroded. Included are small areas of shallow Klinesville soils.

Leck Kill channery silt loam, 15 to 25 percent slopes, severely eroded, is better suited to pasture or trees than to tilled crops. The pastures should be seeded to birdsfoot trefoil or other long-lived perennial plants. Diversion terraces are needed to protect newly seeded areas. Lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit VIe–2; woodland suitability group 7.)

Leck Kill very stony loam, 0 to 8 percent slopes (LkB).—This soil has a thin, black surface layer and a reddish-gray or brown subsurface layer. Numerous stones from nearby formations litter the surface. The rest of the profile is similar to the one described as typical for the Leck Kill series. Included with this soil are small, extremely stony areas.

Leck Kill very stony loam, 0 to 8 percent slopes, is better used for trees or pasture than for tilled crops. Most areas are too stony for cultivation. The present woodlands consist mainly of chestnut oak and red maple, and most of them are in poor condition. Fire prevention is the main need. (Capability unit VIs–2; woodland suitability group 6.)

Leck Kill very stony loam, 8 to 25 percent slopes (LkD).—The profile of this soil is similar to the one described as typical for the series, but this soil has stronger slopes, and there is an accumulation of organic matter on the surface. Most of this soil overlies red beds and is near the bases of mountains. Included are areas near East Side that have been cleared of stones, and there are also areas of rock outcrop.

Leck Kill very stony loam, 8 to 25 percent slopes, is too stony for cultivation. It is suited to pasture or trees. Most of it is in trees, mainly red oak, black oak, hemlock, and red maple. The soil has a moderate supply of moisture because of natural drainage from higher areas.

Fire protection and other management practices are needed to improve the woodlands. (Capability unit VIs–2; woodland suitability group 7.)

Leck Kill very stony loam, 25 to 100 percent slopes (LkF).—The profile of this soil, except for stoniness, is similar to the one described for the series. This soil is shallowest near the tops of ridges. It is deeper at the bases of slopes because of soil creep. Most of this soil is in the Pocono Mountain resort area and is used for recreation. Included are areas of rock outcrop.

Leck Kill very stony loam, 25 to 100 percent slopes, is all wooded. It is suited to trees or wildlife areas, but it is too stony and steep for cultivation.

Products taken from wooded areas of this soil are evergreens, rhododendron, aspen for bindings, and material for the production of wintergreen oil. The woodlands consist chiefly of trees that grow slowly or that are in nearly inaccessible areas. Fire protection is the main need. In areas of this soil near the Lehigh River in Kidder Township, a formation of red, fine-grained sandstone is quarried for flagstone. (Capability unit VIIs–3; woodland suitability group 8.)

Lickdale Series

The Lickdale series consists of soils in swamps. The surface layer is black, mucky silt loam that is underlain by grayish, waterlogged silty clay loam to silty clay. The subsoil, at a depth of 15 to 30 inches, is yellowish-brown silty clay loam or silty clay.

The Lickdale soils have formed in deep glacial till, derived mainly from fine-grained, gray sandstone, siltstone, shale, and conglomerate. The native vegetation was hemlock, black spruce, swamp blueberry, black alder, and sphagnum moss.

In Carbon County the Lickdale soils are mapped only in undifferentiated soil groups with the Tughill soils. They have formed from finer grained materials than the Tughill soils and have more silt in the surface layer and more clay in the subsoil. Other soils that have formed near or adjacent to the Lickdale are the Hazleton, Drifton, Alvira, Shelmadine, Swartswood, Wurtsboro, and Volusia.

Lickdale and Tughill loams and silt loams, 0 to 3 percent slopes (LsA).—This mapping unit consists of Lickdale and Tughill soils. A profile of a representative Tughill soil is described under the Tughill series. Lickdale soils resemble Tughill soils but are more silty.

The high water table in both soils makes them unsuited to cultivation. Their use for pasture is limited, unless open ditches are built for drainage. The soils are suited to natural water storage. They are also suitable for growing cranberries, blueberries, native spruce for Christmas trees, and sphagnum moss. Windthrow among trees is common. (Capability unit Vw–1; woodland suitability group 5.)

Lickdale and Tughill very stony loams, 0 to 8 percent slopes (LtA).—The profiles of soils in this mapping unit are like the one described as typical of the Tughill series. Included are some extremely stony and small, nonstony areas.

Stoniness and the high water table make Lickdale and Tughill very stony loams, 0 to 8 percent slopes, unsuited to cultivation. The soils are best used for natural water storage or for growing cranberries, blueberries, native spruce for Christmas trees, and sphagnum moss. Wildlife areas can be developed, but the production of timber is limited. (Capability unit VIIs–2; woodland suitability group 5.)

Lordstown Series

The Lordstown series consists of shallow to moderately deep soils on ridges and steep slopes. The soils have a thin, grayish, mineral surface layer that overlies a bright yellowish-brown subsoil. Their color indicates that the soils have good drainage.

The Lordstown soils have formed from glacier-worked sandstone and siltstone mixed with conglomerate and shale. They are all in Kidder Township. Much of Hickory Run State Park is on these soils.

The original vegetation on the Lordstown soils was mixed oaks and northern hardwoods. Present woodlands consist mainly of thin, poor stands of chestnut oak, red maple, and sassafras. Less important species are aspen, gray birch, and white and black oaks.

These soils have formed from parent material similar to that of the Swartswood, Wurtsboro, Volusia, Lickdale, and Tughill soils. The Lordstown soils generally occur in higher positions and are steeper than these other soils.

Typical profile (Lordstown very stony silt loam on a slope of 20 percent, wooded):

- A_0 2 inches to 0, black (10YR 2/1) mor-type organic layer with some black (N 2/0) charcoal held together by many roots; mantle of stones on surface; greasy when wet; extremely acid (pH 4.4); abrupt, broken lower boundary; layer ranges from 0 to 3 inches in thickness within a distance of a few feet.
- A_2 0 to 4 inches, grayish-brown (10YR 5/2) channery sandy loam; 90 percent of mass is coarse fragments; few roots; abrupt, wavy lower boundary; layer ranges from 2 to 6 inches in thickness.
- B_{11} 4 to 6 inches, dark yellowish-brown (10YR 4/4) silt loam; 10 percent of mass is coarse fragments up to 4 inches in length; very weak, fine, subangular blocky structure; friable when moist; numerous roots; extremely acid (pH 4.5); clear, irregular lower boundary; layer ranges from 1 to 3 inches in thickness within a distance of a few feet.
- B_{21} 6 to 14 inches, yellowish-brown (10YR 5/4) channery silt loam; 20 percent of mass is coarse fragments; weak, fine, subangular blocky structure; very thin, discontinuous clay films on peds; friable when moist, slightly sticky when wet; numerous roots; very strongly acid (pH 4.9); gradual, wavy lower boundary; layer ranges from 6 to 10 inches in thickness within a distance of a few feet.
- B_{22} 14 to 26 inches, yellowish-brown (10YR 5/6) channery silt loam; 20 percent of mass is fragments; weak, fine, to medium, subangular blocky structure; thin, discontinuous clay films on peds; friable when moist, slightly sticky when wet; few roots; very strongly acid (pH 4.8); gradual, wavy lower boundary; layer ranges from 8 to 16 inches in thickness within a distance of a few feet.
- C 26 inches +, yellowish-brown (10YR 5/6) channery loam; 80 percent of mass is coarse fragments; very strongly acid (pH 4.8).

The Lordstown soils are 18 to 36 inches deep, and bedrock is commonly at a depth between 24 and 30 inches. The texture is mainly silt loam, but it ranges to loam or light silty clay loam that overlies massive bedrock. The texture depends on the texture of the parent material. In places the clay films are thick. The A_2 layer varies greatly in thickness, ranging from ¼ inch in some places to as much as 12 inches on ridges that are extremely chan-

nery or stony. The colors are mainly hues of 10YR, but they range from 7.5YR to 2.5Y.

The Lordstown soils are naturally very strongly acid and have moderately rapid to rapid permeability. Leaching of plant nutrients is moderate, and the available moisture-holding capacity is moderate to moderately low. Internal drainage is rapid or moderately rapid.

Lordstown very stony silt loam, 0 to 8 percent slopes (LvB).—In places this soil has a heavier texture than the soil described as typical of the series, and in places it is thicker. The texture of the surface layer ranges to loam or silty clay loam. Included with this soil are small areas near the glacial boundary that have a moderately thick subsoil of sandy clay loam.

Lordstown very stony silt loam, 0 to 8 percent slopes, is suited to pasture, trees, and wildlife areas. The vegetation is suited to the protection of the watershed. Because of stones, the soil is not suitable for cultivation. Prevention of fire is urgently needed in the woodlands, and in places the trees should be thinned and mature trees harvested. The present woodlands consist mainly of chestnut oak and red maple, which are the best of the inferior species growing on this soil. Stands of white and black oaks are of small extent. (Capability unit VIs–2; woodland suitability group 6.)

Lordstown very stony silt loam, 8 to 25 percent slopes (LvD).—The profile of this soil is like the one described as typical of the Lordstown series. Included with this soil are a few small areas that have a moderately thick subsoil of sandy clay loam. These areas are near the glacial boundary.

Lordstown very stony silt loam, 8 to 25 percent slopes, is suited to pasture, trees, and wildlife areas. Because of the stones and outcrops, it is not suited to cultivation. Most of the woodlands are made up of thin, weak stands of trees. Chestnut oak and red maple, mixed with a few white and black oaks, are the most valuable species. Protection from fire is needed. (Capability unit VIs–2; woodland suitability group 7.)

Lordstown very stony silt loam, 25 to 80 percent slopes (LvF).—This soil has steeper slopes and is generally somewhat shallower over bedrock than Lordstown very stony silt loam, 8 to 25 percent slopes. As a result of soil creep, it is deeper near the bottom of the slopes. Otherwise, the profile is like the one described as typical of the series. This soil is in the Pocono Mountains resort area and is used for recreation. Included are areas of rock outcrops.

Lordstown very stony silt loam, 25 to 80 percent slopes, is mainly suited to trees or to wildlife areas, and the vegetation is suited to watershed protection. Chestnut oak, aspen, and red maple are the main species in the present woodlands. Fire prevention is needed to protect the trees and to encourage their natural reproduction. (Capability unit VIIs–3; woodland suitability group 8.)

Made Land

Made land (Ma)—This mapping unit consists of areas of very severely eroded land and of urban areas, garbage dumps, filled areas, railroad rights-of-way, and other artificially made land.

Some of the filled areas can be planted to trees, and few might have some agricultural use. The others are mainly too stony for trees or for agriculture. (Capability unit VIIIs–1; woodland suitability group 12.)

Meckesville Series

The Meckesville series consists of medium-textured, deep, well-drained soils that have a dark-brown surface layer and a reddish-brown subsoil. These soils are mostly stony and are wooded. They have formed on pre-Wisconsin glacial till consisting of mixed red, brown, and gray sandstone and siltstone with some conglomerate and shale.

The Meckesville soils are in positions above the moderately well drained Albrights, the somewhat poorly drained Alvira, the poorly drained Shelmadine, and the very poorly drained Norwich soils. All of these soils have formed from similar parent material. The Meckesville soils are coarser textured than the Allenwood soils.

The Meckesville soils were formed under forests of white pine mixed with some oak. Forest fires have destroyed many of the trees. The present woodlands are a mixture of scrub oak, gray birch, and some white oak.

Typical profile (Meckesville very stony loam on a slope of 5 percent, in a wooded area):

A_{00} 2 inches to ½ inch of leaf litter from hardwoods.

A_0 ½ inch to 0, black (N 2/0) mor layer, containing some charcoal; 30 percent of mass is stones; many roots; extremely acid (pH 4.4); abrupt, wavy lower boundary; layer ranges from ½ to 1 inch in thickness.

A_2 0 to ¼ inch, pinkish-gray (7.5YR 6/2) sandy loam; single grain; abrupt, lower boundary; layer ranges from 0 to 1 inch in thickness within a distance of a few feet.

A'_2 ¼ to 3 inches, dark-brown to brown (7.5YR 4/2 to 5/2) fine sandy loam; 30 percent of mass is stones; weak, very thin, platy structure; friable when moist; many roots; extremely acid (pH 4.2); clear, irregular lower boundary; layer ranges from ½ inch to 4 inches in thickness within a distance of a few feet.

B_{1r} 3 to 4½ inches, dark-brown (7.5YR 3/2) loam; 30 percent of mass is stones; weak, fine, subangular blocky structure; friable when moist; many roots; extremely acid (pH 4.3); clear, irregular lower boundary; layer ranges from ½ inch to 4 inches in thickness within a distance of a few feet.

B_{11} 4½ to 9 inches, dark-brown (7.5YR 4/4) silt loam; 10 percent of mass is stones; weak, fine to medium, subangular blocky structure; friable when moist; many roots; very strongly acid (pH 4.8); gradual, smooth lower boundary; layer ranges from 4 to 6 inches in thickness within a distance of a few feet.

B_{21} 9 to 19 inches, reddish-brown (5YR 4/4) fine gravelly loam to fine sandy loam; 15 percent of mass is stones and pebbles; weak, very thin, platy structure that breaks to weak, fine, granular; friable when moist; many roots; very strongly acid (pH 4.6); gradual, wavy lower boundary; layer ranges from 8 to 12 inches in thickness within a distance of a few feet.

B_{22} 19 to 27 inches, reddish-brown (5YR 4/4), gravelly, heavy loam; 25 percent of mass is coarse fragments; moderate, fine, blocky structure and moderate, medium, platy; thin, discontinuous clay films on peds, thick films in pores; friable when moist, slightly sticky when wet; very strongly acid (pH 4.8); gradual, wavy lower boundary; layer ranges from 6 to 10 inches in thickness within a distance of a few feet.

B_3 27 to 42 inches, reddish-brown (5YR 4/3 to 4/4) stony loam; 65 percent of mass is stones and pebbles; moderate, fine, blocky structure; thin, discontinous clay films on peds; friable when moist; very strongly acid (pH 4.8); gradual, wavy lower boundary; layer ranges from 12 to 18 inches in thickness within a distance of a few feet.

C 42 inches +, stony sandy loam; 80 percent of mass is stones and pebbles.

The Meckesville soils, in some places in Penn Forest and Kidder Townships, are underlain by older soils that have a texture of clay loam. These underlying soils are commonly separated from the Meckesville soils by a thin, stony and sandy layer, which is at a depth of 24 inches or more. The texture of the B horizon in the Meckesville soils ranges from stony loam to silty clay loam, and color ranges from hues of 2.5YR to 7.5YR. Bedrock is at a depth ranging from 3 to 25 feet.

Where the Meckesville soils intergrade to Albrights soils, at the bases of slopes, there is a distinct fragipan in places at a depth of 24 inches or more. In many forested areas, the uppermost part of the soil consists of a podzolic profile, 4 to 8 inches thick.

Internal drainage and permeability are moderate to moderately rapid in these soils. The available moisture-holding capacity is moderate to high. Meckesville soils have strong natural acidity and low fertility.

Meckesville channery loam, 0 to 3 percent slopes (MbA).—This soil has a dark-brown plow layer, which is channery and gravelly but has had the stones removed. Its profile is similar to the one described as typical for the Meckesville series but is deeper. This soil is on broad, nearly level upland ridges. Included are areas of non-stony, undisturbed soils and small areas of soils that are moderately well drained.

Meckesville channery loam, 0 to 3 percent slopes, is well suited to most of the crops grown in the county. Early frosts, however, are a hazard to corn and other late-maturing crops grown in the mountains. Frosts are less hazardous in other areas. This soil needs only simple management practices to protect it from erosion. Contour tillage and the use of cover crops protect it effectively. Lime and fertilizer should be applied according to the needs indicated by soil tests and according to the crop to be grown. (Capability unit I–2; woodland suitability group 1.)

Meckesville channery loam, 3 to 8 percent slopes, moderately eroded (MbB2).—This soil has a dark-brown plow layer, and it is channery and gravelly. Otherwise, its profile is similar to the one described as typical of the series. The soil is on long, moderate slopes.

All crops grown in the county yield well on this soil if lime and fertilizer are applied in proper amounts. Erosion is enough of a hazard that stripcropping and winter cover crops are needed to protect the soil. Diversion terraces are needed on long slopes to control runoff. Early frosts are a hazard to corn and other late-maturing crops grown in the mountains. (Capability unit IIe–1; woodland suitability group 1.)

Meckesville channery loam, 8 to 15 percent slopes, moderately eroded (MbC2).—Except for being channery rather than stony, and having a dark-brown surface layer, this soil is similar to the one described as typical of the Meckesville series. Slopes are moderately long. This soil is not extensive. Included are some areas that are severely eroded.

Meckesville channery loam, 8 to 15 percent slopes, moderately eroded, is well suited to most crops. Erosion is a problem because of the slope. Diversion terraces and contour stripcropping are needed to control runoff and erosion and to allow water to soak into the ground. Winter cover crops will improve the tilth of the soil and protect it from erosion. Lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit IIIe–1; woodland suitability group 2.)

Meckesville very stony loam, 0 to 8 percent slopes (McB).—The profile of this soil is like the one described as typical of the Meckesville series. Most of the soil is too stony for cultivation. It is suited to pasture or trees, and nearly all of it is wooded. Most of the woodlands are in poor condition because of destructive logging and fires in the past. The prevention of forest fires is the most serious management problem. Tree growth and the condition of the woodlands will improve as the result of fire prevention. The original forests consisted of white pine mixed with several species of oak. Present woodlands consist of white and scrub oaks, gray birch, pitch pine, and red maple. (Capability unit VIs–1; woodland suitability group 1.)

Meckesville very stony loam, 8 to 25 percent slopes (McD).—The profile of this soil is similar to the one described as typical for the Meckesville series. Included are a few areas of stratified sandy and gravelly outwash.

Meckesville very stony loam, 8 to 25 percent slopes, is too stony for cultivation, but it is suited to pasture and trees. On most of it, fire has severely damaged the vegetation; consequently, prevention of fire is the most serious problem in management. The better stands of white oak, white pine, and red maple need to be thinned to improve their rate of growth. (Capability unit VIs–1; woodland suitability group 2.)

Middlebury Series

The Middlebury series consists of deep, moderately well drained soils that have a dark grayish-brown surface layer and a brownish subsoil. The soils are along many streams in the county.

Middlebury soils have formed from medium- to fine-textured material that was deposited by streams during periods of overflow. Their profile has a uniform texture. It is underlain by coarse-textured material at a depth of about 30 to 120 inches.

In some areas the Middlebury soils are below the well-drained Tioga soils, notably along Aquashicola Creek. Along many other streams, they adjoin the somewhat poorly to poorly drained Holly soils. In the Quakake Valley and along Mahoning Creek, the Middlebury soils are associated with the very poorly drained Papakating soils.

The Middlebury soils have formed under native vegetation consisting of hickory, white oak, hemlock, tulip-poplar, and less important species. Present woodlands consist of hickory, wild cherry, white oak, and maple.

Typical profile (Middlebury silt loam in a level area, idle):

A_p 0 to 11 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, medium, granular structure with a tendency to weak, medium, platiness; friable when moist, slightly sticky when wet; mass of roots as much as 4 inches but commonly 11 inches long; many dark grayish-brown (10YR 4/2) worm casts; slightly acid (pH 6.2); clear, smooth lower boundary; layer ranges from 10½ to 11½ inches in thickness within a distance of a few feet.

AC 11 to 16 inches, dark-brown (10YR 4/3) silt loam; weak, fine to medium, blocky structure breaking to weak, medium, platy; friable when moist, sticky when wet; common roots; slightly acid (pH 6.1); gradual, wavy lower boundary; layer ranges from 4 to 7 inches in thickness within a distance of a few feet.

C_1 16 to 25 inches, yellowish-brown (10YR 5/4) silt loam; weak, medium to thick, platy structure; few, fine pebbles; friable when moist, sticky when wet; few, fine roots; common dark grayish-brown (10YR 4/2) worm casts, and few, fine, prominent, black (10YR 2/1) coatings; slightly acid (pH 6.2); gradual, wavy lower boundary; layer ranges from 7 to 11 inches in thickness within a distance of a few feet.

C_2 25 to 32 inches, light-brown (10YR 5/3 to 6/3), heavy silt loam; 10 percent of mass is fine pebbles; few, fine, distinct mottles of strong brown (7.5YR 5/6); weak to moderate, medium, platy structure; friable when moist, sticky and slightly plastic when wet; few, fine roots; common, medium, prominent, black (10YR 2/1) coatings; slightly acid (pH 6.3); diffuse, irregular lower boundary; layer ranges from 3 to 11 inches in thickness within a distance of a few feet.

D_1 32 to 38 inches, light reddish-brown (5YR 6/3) gravelly clay loam; mottles of yellowish red and reddish brown (7.5YR 5/6 and 7.5YR 4/4); 20 percent of mass is fine, angular pebbles less than ½ inch in diameter; weak, medium, subangular blocky structure tending to platiness; very firm when moist, sticky and slightly plastic when wet; weakly cemented by a mass of clay and iron oxides; many, medium, prominent, black (10YR 2/1) coatings; moderately acid (pH 6.0).

D_2 38 inches +, gravelly silt loam.

The texture of the Middlebury soils is mostly silt loam but ranges to silty clay loam. Colors are mostly hues of 7.5YR, but they range from hues of 5YR to 10YR. The profiles are commonly 30 to 36 inches deep, but they range from 24 to 44 inches in depth. The layer of stratified sand, silt, and clay is as much as 10 feet deep over bedrock.

These soils have moderate permeability, and their available moisture-holding capacity is high. Internal drainage is moderate. Because the Middlebury soils are near the level of streams, they have a seasonal high water table.

Middlebury silt loam, 0 to 3 percent slopes (MdA).—The profile of this soil is like the one described as typical of the Middlebury series. Included are some areas of overflow and deposition and other areas, around Lake Harmony and Broad Mountain, consisting of locally ponded sediment. Also included are areas that have stones on the surface.

Middlebury silt loam, 0 to 3 percent slopes, is suited to shallow-rooted crops. A high water table and drainage from higher areas make it wet part of the time. An open drainage system and diversion terraces are needed to improve the soil for all the crops commonly grown. In winter, because of the hazard of overflow, it should be protected by a cover crop. Lime and fertilizer ought to be applied according to the needs indicated by soil tests. (Capability unit IIw–1; woodland suitability group 3.)

Middlebury silt loam, 3 to 8 percent slopes (MdB).—This soil is mainly along small streams that are tributary to major streams. It has better surface drainage than Middlebury silt loam, 0 to 3 percent slopes. Part of it has formed from colluvial parent material. Otherwise, the profile of this soil is similar to the one described as typical for the Middlebury series. Included are a few areas in which stones are in the surface layer; small areas having slopes of 8 to 15 percent; and areas in which drainage is poor.

The movement of machinery is difficult on Middlebury silt loam, 3 to 8 percent slopes, because many areas are small and have been cut up by streams. The soil is well suited to hay, pasture, and shallow-rooted crops. Surface drainage and random closed drains are needed to remove excess water. Contour cultivation and winter cover crops, together with some form of drainage, are needed to prevent erosion. Lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit IIw–1; woodland suitability group 3.)

Middlebury and Tioga silt loams, 0 to 3 percent slopes, severely eroded (MeA3).—These soils are near streams, and part of their profiles have been removed by stream action. In some areas the soils are intact, but in eroded areas they have lost from one-half to three-fourths of their original soil profile. A typical profile of the Tioga component is described under the Tioga series.

The soils in this mapping unit are better suited to pasture than to cultivated crops. Trees are best where the hazard of erosion is high. (Capability unit IVe–4; woodland suitability group 3.)

Mine Dumps

Mine dumps (Mm).—This miscellaneous land type consists, in part, of the refuse and discard of coalbreakers. It includes mounds of black siltstone and shale. These mounds are near areas where coalbreakers are operating or where these machines were once located. The areas also consist of sandstone, siltstone, conglomerate, shale rock, and soil material around the openings of the shafts of deep mines. Much of the latter material is coarse textured, but it includes medium-textured material.

Some mine dumps have seeded naturally to gray birch, which is a weed species. They have a fairly good cover of birch. Most of the mine dumps are very acid and stony and contain much black shale. As a result, the planting of trees or the establishing of other vegetation is difficult. One area, one-fourth mile west of Nesquehoning, on Pennsylvania Route 45, has a dense cover of sweetclover growing on it. (Capability unit VIIIs–1; woodland suitability group 12.)

Mine dumps, coal (Mn).—This miscellaneous land type consists of small areas made up of mounds of fine residue from coalbreakers. The material in the mounds consist of black particles of slate, shale, and coal, about one-eighth inch in diameter. Most of it is very acid.

Figure 5.—**Mound of fine residue, or culm, from an old coalbreaker one-quarter of a mile west of Nesquehoning. The vegetation on the mound is gray birch.**

Much of the fine coal in these areas has been removed or is being removed for use as fuel in modern, efficiently designed furnaces. In places gray birch has seeded itself naturally on these areas (fig. 5). (Capability unit VIIIs–1; woodland suitability group 12.)

Montevallo Series

The Montevallo series consists of shallow, well-drained channery silt loams on uplands. The soils have a very dark grayish-brown surface layer and a brown to yellowish-brown subsurface layer. They are in a rectangle formed by NE–SW lines, extending from Jamestown on the north to the eastern boundary of the county and from Stony Ridge on the south to the western boundary of the county.

The Montevallo soils have formed in place from frost-worked, gray, thin-bedded, acid shale and siltstone with some sandstone. They have formed as an aftermath of Wisconsin glacial frost action (*5*, *6*).

Most areas of Montevallo soils were once farmed, but they are now idle. Some of the drier and more channery areas have reverted to woodland. Good crops are grown only when there is plenty of moisture and plant food in the soils.

Montevallo soils occur on shaly material with the deep, well drained Hartleton, the moderately well drained to somewhat poorly drained Comly, and the poorly drained Shelmadine soils. In degree of profile development, the Montevallo soils are like the reddish-colored Klinesville soils. They have a color similar to that of the Dekalb soils, but they contain more silt and less sand and are generally shallower.

Typical profile (Montevallo channery silt loam, 15 to 25 percent slopes, severely eroded, idle):

A_p 0 to 5 inches, very dark grayish-brown (10YR 3/2) channery silt loam; weak, fine, granular structure; friable when moist; 40 to 50 percent of mass is channery fragments; many roots; moderately acid (pH 5.5); clear, wavy lower boundary; layer ranges from 4 to 6 inches in thickness within a distance of a few feet.

B_3 5 to 12 inches, brown (10YR 5/3) very channery silt loam; weak, fine, granular structure; friable when moist; 60 percent of mass is channery fragments; some roots; strongly acid (pH 5.2); clear, irregular lower boundary; layer ranges from 4 to 10 inches in thickness within a distance of a few feet.

C_1 12 to 23 inches, brown (10YR 5/3) rock fragments; silty clay coatings; 90 percent of mass is channery fragments; few roots; strongly acid (pH 5.2); clear, irregular lower boundary; layer ranges from 10 to 14 inches in thickness within a distance of a few feet.

C_2 23 inches +, dark grayish-brown (2.5Y 4/2) to olive-brown (2.5Y 4/4) siltstone; silt and clay coatings on upper surfaces of fragments; iron and manganese coatings on stones; strongly acid (pH 5.2).

The texture of these soils is channery silt loam or shaly silt loam. The color of the soils depends on the color of the underlying rock strata. The subsurface layer ranges from dark brown (7.5YR 4/4) to light yellowish brown (10YR 6/4) in color. The depth of the channery silt loam ranges from 5 to 18 inches.

The Montevallo soils are rapidly permeable, have low available moisture-holding capacity, and are well aerated. They are naturally acid throughout and have rapid internal drainage.

Montevallo channery silt loam, 0 to 3 percent slopes (MoA) —The profile of this soil has a higher proportion of fine soil material than the one described as typical for the Montevallo series. Areas of moderately deep soils are included. Because of the nature of the underlying rock strata, some areas of reddish Klinesville soils are also included.

Montevallo channery silt loam, 0 to 3 percent slopes, is only moderately well suited to corn, but it is less well suited to potatoes. Small grains grow better than either of these crops because moisture is available early in the growing season. Hay and pasture, planted to birdsfoot trefoil, produce good forage. Contour farming and cover crops are needed to hold rain where it falls. Lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit IIIe–4; woodland suitability group 9.)

Montevallo channery silt loam, 3 to 8 percent slopes, moderately eroded (MoB2).—The profile of this soil resembles the one described as typical for the series, except that it is slightly deeper, less channery, and has more silt and clay in the subsurface layer. Included are areas in which the soil has a moderately deep profile and areas in which there are reddish stones in the profile.

Montevallo channery silt loam, 3 to 8 percent slopes, moderately eroded, has formed on gently sloping hillsides and benches. About half of this soil is idle, and the rest is divided between woodland and cropland. A small acreage is in pasture and in boroughs.

This soil is droughty and low in fertility, and it has a shallow root zone. Erosion is more of a problem than it is on Montevallo channery silt loam, 0 to 3 percent slopes.

A moderately long cropping system, contour farming, and, in places, diversion terraces are needed to hold moisture and control erosion. Cover crops ought to be grown after corn is harvested to protect the soil and to provide organic matter. Lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit IIIe–4; woodland suitability group 9.)

Montevallo channery silt loam, 3 to 8 percent slopes, severely eroded (MoB3).—The plow layer of this soil is very dark brown and contains yellowish-brown particles of soil material. Otherwise, the profile is similar to the one described as typical for the Montevallo series. Some of the areas have a few shallow gullies.

This soil is droughty and has a shallow root zone. It is only fairly well suited to corn and oats and is moderately well suited to wheat. A long cropping system that includes 2 or 3 years of hay is best for this soil. Contour strips, occasional diversion terraces, and cover crops are needed to protect the soil from erosion. The cover crop should be planted in the cornfields after the corn has been harvested. Lime and fertilizer ought to be applied according to the needs indicated by soil tests. (Capability unit IVe–3; woodland suitability group 9.)

Montevallo channery silt loam, 8 to 15 percent slopes, moderately eroded (MoC2).—This soil is on the longer slopes of the ridge-and-valley area. It is deeper, less eroded, and less channery than Montevallo channery silt loam, 15 to 25 percent slopes, severely eroded, and it contains a little more silt and clay.

This soil is shallow, and most of it is idle. The conservation practices suggested for Montevallo channery silt loam, 3 to 8 percent slopes, severely eroded, are also good for this soil. (Capability unit IVe–3; woodland suitability group 10.)

Montevallo channery silt loam, 8 to 15 percent slopes, severely eroded (MoC3).—The profile of this soil is like the one described as typical for the Montevallo series. Some areas having shallow gullies are included.

Most of Montevallo channery silt loam, 8 to 15 percent slopes, severely eroded, is on the upper parts of long slopes. The soil is shallow, and most of it is idle. It is best suited to grasses and legumes, but it can be used occasionally for tilled crops. The cropping system should include several years of hay. Fields intended for hay ought to be seeded in contour strips. Diversion terraces are needed to control runoff and erosion. Lime and fertilizer ought to be applied according to the needs indicated by soil tests and according to the crop to be grown.

Trees grow slowly on this soil because of the low available moisture-holding capacity. The soil is suitable for the production of Christmas trees. (Capability unit VIe–2; woodland suitability group 10.)

Montevallo channery silt loam, 15 to 25 percent slopes, moderately eroded (MoD2).—The profile of this soil is similar to the one described as typical for the Montevallo series, except that it is less channery and is slightly deeper over the C horizon. Included are some slightly eroded areas.

Montevallo channery silt loam, 15 to 25 percent slopes, moderately eroded, is on short slopes and on the steeper parts of long slopes. This soil is shallow. It is suited to permanent hay and occasionally to a tilled crop. Fields intended for hay should be seeded in contour strips to birdsfoot trefoil or other drought-resistant plants. Diversion terraces are needed to control erosion and conserve moisture. Lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit VIe–2; woodland suitability group 10.)

Montevallo channery silt loam, 15 to 25 percent slopes, severely eroded (MoD3).—The profile of this soil is like the one described as typical for the Montevallo series. This is the most extensive soil in the series. Most of it is idle, but part of it is used as pasture for sheep. Included are areas with shallow gullies and outcrops of rock.

Montevallo channery silt loam, 15 to 25 percent slopes, severely eroded, is shallow. Because of steepness and droughtiness, it is better suited to pasture and trees than to tilled crops. The pastures provide fair yields if they are seeded to birdsfoot trefoil and other drought-resistant plants. The soil can be used for growing Christmas trees. Diversion terraces are needed to control runoff at critical places on the slopes. (Capability unit VIIe–1; woodland suitability group 10.)

Montevallo channery silt loam, 25 to 35 percent slopes, moderately eroded (MoE2).—This soil is on the steeper parts of ridges. Its profile is similar to the one described as typical for the series, except that the surface layer contains more coarse fragments, and loose bedrock is at a depth of about 8 to 12 inches. Included are slightly eroded, wooded areas.

Montevallo channery silt loam, 25 to 35 percent slopes, moderately eroded, is shallow and droughty. Trees grow too slowly for the production of pulpwood and other forest products to be successful. However, the proper species can be grown for Christmas trees. The vegetation on this soil is suitable for wildlife habitats and for watershed protection. Fire prevention is needed in many areas. (Capability unit VIIe–1; woodland suitability group 11.)

Montevallo channery silt loam, 25 to 35 percent slopes, severely eroded (MoE3).—This soil is in the steeper parts of the county. Its profile is like the typical profile described for the series, except that it is shallower. The C horizon is at a depth of about 6 inches. Most of the acreage is idle.

This soil is droughty, and trees grow very slowly on most sites. It is well suited to the production of Christmas trees, but it is only moderately well suited to the production of pulpwood or other forest products. The trees grow most rapidly on slopes facing north and northeast, where there is more available moisture in the soil. (Capability unit VIIe–1; woodland suitability group 11.)

Montevallo channery silt loam, 35 to 100 percent slopes, eroded (MoF2).—The profile of this soil is shallower and stonier than the one described as typical for the series. Most of the soil is extremely channery, but some areas are very shaly. Included is a small acreage that is severely eroded and several areas of rock outcrop.

Montevallo channery silt loam, 35 to 100 percent slopes, eroded, is on steep slopes above streams. The streams have cut through the bedrock, and the steep slopes have resulted. Soil creep is evident in most places, as indicated by leaning trees and accumulations of rubble at the bases of slopes.

This soil is shallow and droughty, and most of it is wooded. The trees should be managed for woodland products or for watershed protection. Practices to prevent fire are needed. (Capability unit VIIe–1; woodland suitability group 11.)

Morris Series

The Morris series consists of somewhat poorly drained to poorly drained, medium-textured soils on uplands. The soils have a very firm (fragipan) horizon at a depth of 10 to 18 inches. They have developed on firm, acid till derived from reddish sandstone, siltstone, and shale from the last glacial period.

The Morris soils have formed in parent material similar to that of the Norwich, Meckesville, and Albrights soils. In most places they occur above the very poorly drained Norwich soils and below the well drained Meckesville and the moderately well drained Albrights soils.

Beech and hard maple, mixed with oak, were the main kinds of trees in the native vegetation on the Morris soils. The present woodlands consist of red maple, beech, and red and white oaks.

Only one soil of this series, Morris very stony silt loam, 0 to 8 percent slopes, was mapped in Carbon County.

Typical profile (Morris very stony silt loam on a slope of 3 percent, in a wooded area):

A_0 1 inch to 0, black (N 2/0) very stony silt loam; 60 percent of mass is slightly rounded stones up to 12 inches in length; weak, fine, crumb structure; many roots; extremely acid (pH 4.4).

A_1 0 to 3 inches, black (5YR 2/1) very stony silt loam; 50 percent of mass is slightly rounded stones up to 12 inches in length; weak, medium, granular structure; friable when moist; numerous roots; extremely acid (pH 4.3); clear, wavy lower boundary; layer ranges from 2 to 4 inches in thickness within a distance of a few feet.

B_2 3 to 9 inches, dark-brown (7.5YR 4/4) silt loam; 30 percent of mass is stones up to 8 inches in diameter; moderate, medium, subangular blocky structure; friable when moist, nonsticky; numerous roots; ex-

tremely acid (pH 4.5); clear, wavy lower boundary; layer ranges from 5 to 7 inches in thickness within a distance of a few feet.

A'_2 9 to 14 inches, brown (7.5YR 5/4) channery silt loam; weak, thin to medium, platy structure; friable when moist, nonsticky; numerous roots; very strongly acid (pH 4.7); clear, smooth lower boundary; layer ranges from 4 to 6 inches in thickness within a distance of a few feet.

B_{2g} 14 to 21 inches, reddish-brown (5YR 5/3), channery, light silty clay loam; common, fine, faint mottles; weak, thin, platy structure tending to massive; thin, discontinuous films of clay and manganese on peds; very firm (fragipan horizon) when moist, slightly sticky when wet; very strongly acid (pH 4.7); gradual, wavy lower boundary; layer ranges from 5 to 9 inches in thickness within a distance of a few feet.

B_{3g} 21 to 44 inches, reddish-brown (5YR 5/3), channery, light silty clay loam; common, medium, distinct mottles of strong brown (7.5YR 5/6) and pinkish gray (5YR 6/2); weak, medium, platy structure tending to massive; thin, discontinuous clay films and films of manganese on peds; very firm when moist, slightly sticky when wet; very strongly acid (pH 4.7); diffuse, wavy lower boundary; layer ranges from 16 to 25 inches in thickness within a distance of a few feet.

C_{1g} 44 inches +, reddish-brown (5YR 5/4) channery silt loam; many, fine and medium, prominent mottles of light brown (7.5YR 6/4) and light gray (5YR 7/1); 50 percent of mass is stones up to 8 inches in diameter; very firm in place; very strongly acid (pH 4.8).

In poorly drained areas, mottling extends to within 4 or 5 inches of the surface or to the bottom of the A_1 horizon. The pan is at a depth between 10 and 18 inches. Cradle knolls, or tree-throw areas, have better drainage than the adjoining depressed areas.

Morris soils have moderate to low available moisture-holding capacity. They are slowly to very slowly permeable. Some water can pass through cracks in the fragipan. Runoff and the hazard of erosion are moderate.

Morris very stony silt loam, 0 to 8 percent slopes (MrB).—The profile of this soil is like the one described as typical of the Morris series. Except for two small, nearly level and gently sloping areas near East Side, which have been cleared for farming, this soil is generally too stony for cultivation. It is suited to pasture or trees. Some woodlands contain thick stands of red maple, oak, beech, and gray birch. A few areas contain white ash, white pine, black birch, and hemlock. Wetness and windthrow are problems in woodland management. Fire prevention is needed. (Capability unit VIIs–1; woodland suitability group 4.)

Muck and Peat

Muck and Peat consist of organic deposits in bogs and swamps. The deposits were derived from sedges, mosses, leaves, roots, and woody vegetation laid down in permanent bodies of water. Muck consists of organic debris that is more decomposed than that from which Peat has formed. In recent geologic time, glaciers covered the area. They dammed up streams and formed depressions in which water was trapped. Muck and Peat formed in these depressions.

Most areas of Muck and Peat are in Kidder Township; a few are in Penn Forest Township. Deposits of Muck and Peat range from 18 inches to more than 30 feet in thickness. They are underlain by acid glacial till or by outwash of sandstone, siltstone, and shale. The native vegetation consists of black spruce, hemlock, and some larch and sphagnum moss. Only one type of Muck and Peat was mapped in Carbon County.

Muck and Peat (Mu).—This mapping unit has a surface layer of platelike, matted roots and sphagnum moss, as much as 5 inches thick. At a depth of 5 to 18 inches is a very strongly acid (pH 4.8) layer of very dark grayish-brown (10YR 3/2) peaty muck that contains many roots. At a depth of 18 to 60 inches or more is a very strongly acid (pH 4.8) layer of black (N 2/0) muck that contains loose roots. The thickness of Muck and Peat over the underlying sandy glacial till ranges from 18 inches to more than 30 feet.

The soils in this mapping unit are underlain by water all or most of the time. The areas range in size from small potholes to bogs of 50 to 60 acres. None of the areas are used agriculturally or commercially in Carbon County. (Capability unit VIIw–1; woodland suitability group 13.)

Natalie Series

The Natalie series consists of soils that are moderately well drained to somewhat poorly drained and are medium textured to coarse textured. The soils have a light-gray to grayish-brown, mineral surface layer and a dark yellowish-brown to yellowish-brown subsoil. Mottling occurs at a depth of about 12 to 21 inches, and a fragipan is at a depth of 18 to 25 inches.

The Natalie soils have formed from glaciated, coarse sandstone and conglomerate. They are mainly in the coal regions, but a few areas are along Stony Ridge in the southern part of the county. These soils are stony and are wooded. The native vegetation consisted of mixed oaks and pitch pine. The present woodlands consist of much red maple, gray birch, sassafras, and a ground cover of other vegetation.

The Natalie soils occur with the well-drained Fleetwood and the very poorly drained Andover soils. All of these soils have formed from similar parent material.

Only one soil of this series, Natalie very stony loam, 0 to 8 percent slopes, was mapped in Carbon County.

Typical profile (Natalie very stony loam on a slope of 2 percent, wooded):

A_0 1 inch to 0, very dark gray (N 3/0, dry) duff mor, or organic layer; numerous stones and boulders of sandstone and conglomerate on the surface; many roots; extremely acid (pH 4.1); abrupt, broken lower boundary; layer ranges from 0 to 1½ inches in thickness within a distance of a few feet.

A_1 0 to 2½ inches, black (10YR 2/1, dry) sandy loam; weak, very fine, granular structure; friable when moist; many roots; extremely acid (pH 4.2); abrupt, smooth lower boundary; layer ranges from 2 to 3 inches in thickness within a distance of a few feet.

A_2 2½ to 5 inches, grayish-brown (10YR 5/2) loamy sand; moderate, fine to medium, subangular blocky structure with a tendency to platiness; very friable when moist, nonsticky when wet; some roots; extremely acid (pH 4.4); abrupt, wavy lower boundary; layer ranges from 1½ to 3½ inches in thickness within a distance of a few feet.

B_{2ir} 5 to 6 inches, dark-brown (7.5YR 3/2) silt loam; weak, fine, subangular blocky structure; friable when moist, sticky when wet; some roots; extremely acid (pH 4.2); clear, broken lower boundary; layer ranges from 0 to 1½ inches in thickness within a distance of a few feet.

B_{21} 6 to 12 inches, dark yellowish-brown (10YR 4/4) loam; 15 percent of mass is coarse sand and gravel; weak, fine, subangular blocky structure; very friable when moist, slightly sticky when wet; very strongly acid (pH 4.6); gradual, wavy lower boundary; layer ranges from 5 to 9 inches in thickness within a distance of a few feet.

B_{22} 12 to 18 inches, yellowish-brown (10YR 5/4) sandy clay loam; 10 percent of mass is coarse gravel; moderate, medium to coarse, blocky structure that breaks to moderate, thin, platy; thin, discontinuous clay films on peds; friable when moist, slightly sticky when wet; very strongly acid (pH 4.6); clear, wavy lower boundary; layer ranges from 5 to 8 inches in thickness within a distance of a few feet.

B_{23} 18 to 32 inches +, light olive-brown (2.5Y 5/3) sandy clay loam; many, coarse, distinct mottles of dark grayish brown (2.5Y 4/2); 15 percent of mass is stones up to 6 inches in diameter; strong, fine to medium, blocky structure that breaks to strong, thin, platy; thick, discontinuous clay films on peds; firm when moist, slightly sticky when wet; extremely acid (pH 4.4).

The mineral surface layer of the Natalie soils is loamy sand, sandy loam, or loam; the subsoil is loam to sandy clay loam. The color ranges from hues of 2.5Y to 7.5YR. The structure may be blocky, subangular blocky, or platy. Bedrock is at a depth of 4 to 20 feet, but it is generally at a depth of 15 feet. Many areas of Natalie soils have been strip mined. Nearly all of the areas are very stony.

The permeability of the Natalie soils is moderately rapid to the pan; below that, it is slow to very slow. The available moisture-holding capacity is moderate. Internal drainage is moderately slow, and the leaching of plant nutrients is moderate. These soils are extremely acid.

Natalie very stony loam, 0 to 8 percent slopes (NaB).—The profile of this soil is like the one described as typical for the Natalie series. Included are areas of Mine dumps, areas that have been strip mined, and stone stripes.

Natalie very stony loam, 0 to 8 percent slopes, is too stony for cultivation. It is suited to pasture, trees, and wildlife areas. Most of the acreage has been burned over several times, and the present woodlands consist mainly of inferior species. Improvement of the stand and the prevention of fire are serious management problems. Wild blueberries and other specialized products are the only harvest obtained on this soil. (Capability unit VIs–3; woodland suitability group 4.)

Norwich Series

The Norwich series consists of very poorly drained soils on glaciated uplands. The soils have a very dark brown or very dark gray surface layer and a gray or grayish-brown subsoil.

These soils have formed from compact glacial till consisting of reddish shale, siltstone, and sandstone. The color of the soil only slightly reflects the color of the parent material because of the reduction processes that occur in wet soil. The soils commonly contain some local alluvial material in the uppermost horizon.

Norwich soils are in depressions or on gentle, concave slopes. In Carbon County they occur as the poorly drained member of the catena to which the Allenwood and Meckesville soils also belong.

Norwich soils have formed under forests that consisted of spruce, hemlock, and some larch and rhododendron, highbush blueberry, and other small shrubs. The present woodlands are similar but are mixed with more red maple, alder, and blueberry.

These soils are finer textured and redder than the very poorly drained, but similar, Lickdale and Tughill soils.

Typical profile (Norwich silt loam, in a level area):

A_{11} 0 to 6 inches, very dark brown (10YR 2/2), mucky silt loam; common streaks of reddish brown (5YR 4/3); weak, medium, granular structure; friable when moist; many grass and sedge roots; strongly acid (pH 5.4); gradual, wavy lower boundary; layer ranges from 4 to 8 inches in thickness within a distance of a few feet.

A_{12} 6 to 12 inches, very dark brown (10YR 2/2) silt loam; common, fine lines of strong brown (7.5YR 5/6) along root channels; weak, coarse, subangular blocky structure to massive; friable when moist, nonsticky when wet; few, fine roots; strongly acid (pH 5.4); clear, wavy lower boundary; layer ranges from 4 to 7 inches in thickness within a distance of a few feet.

B_{21g} 12 to 18 inches, grayish-brown (10YR 6/2), heavy silt loam; many, fine brown streaks along old root channels; weak, coarse, blocky structure to massive; friable when moist; very strongly acid (pH 5.0); gradual, irregular lower boundary; layer ranges from 2 to 10 inches in thickness within a distance of a few feet.

C_{1g} 18 to 22 inches, pinkish-white (7.5YR 7/2) very fine sandy loam with a few, fine pebbles; massive; firm when moist; strongly acid (pH 4.8).

C_{2g} 22 to 27 inches, light-gray (10YR 7/2) loamy fine sand; massive; firm when moist; very strongly acid (pH 4.7); clear, wavy lower boundary; layer ranges from 4 to 6 inches in thickness within a distance of a few feet.

C or D 27 to 33 inches +, gray (N 6/0) gravelly loam; massive; very firm when moist, slightly plastic when wet; very strongly acid (pH 4.7).

The colors of these soils range from hues of 10YR and 2.5YR that are low in chroma to neutral colors of N 5/0 and N 6/0. Some profiles have fine and medium, prominent mottles of strong brown.

Forested areas generally have 2 to 5 inches of mucky material overlying 3 to 8 inches of dark-gray silt loam. On hummocky areas the A_{11} layer is 6 to 12 inches of very dark brown silt loam. The A_{12} layer ranges from silt loam to light silty clay loam or sandy clay loam in texture, because of the proportion of shale or sandstone in the till. The soils are strongly acid to very strongly acid throughout, and there is no evidence of lime in the till.

The available moisture-holding capacity of the Norwich soils is low. However, moisture from the high water table exceeds the field capacity of the soil most of the time. Permeability and internal drainage are very slow.

Norwich silt loam, 0 to 3 percent slopes (NoA).—The profile of this soil is like the one described as typical of the Norwich series.

Erosion and runoff are not problems on this soil. The soil has limited use for pasture. Open ditches or closed drains, where practical, are needed to remove excess water and improve the soil for plant growth. Pasture should be seeded to reed canarygrass (*Phalaris arundinacea*) or other moisture-tolerant grass. If the soil is drained and given proper amounts of lime and fertilizer, fair amounts of forage can be harvested. (Capability unit Vw–1; woodland suitability group 5.)

Norwich silt loam, 3 to 8 percent slopes (NoB).—This soil occupies a small acreage around the heads of hillside springs. The topography is concave. The soil is dotted with clumps of sedges and grasses.

This soil, like Norwich silt loam, 0 to 3 percent slopes, has some use as pasture. In addition to its use for grazing, it provides a source of water for livestock and farm ponds. Diversion terraces and closed drains may be needed on this soil. Lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit Vw–1; woodland suitability group 5.)

Norwich very stony loam, 0 to 8 percent slopes (NvB).—This soil has numerous stones and a few boulders in the surface layer, but otherwise, the profile is similar to the one described as typical of the Norwich series. In places it includes areas of mucky surface deposits as much as 18 inches thick.

This soil is too wet and stony for pasture. It has limited use as woodland, but it is a good source of water for ponds or wildlife. Spruce and tamarack are fairly well suited to the high moisture conditions in this soil. Sphagnum moss makes lush growth. (Capability unit VIIs–2; woodland suitability group 5.)

Papakating Series

The Papakating series consists of deep, very poorly drained soils that have a thick, dark-brown, mucky surface layer and a grayish, heavy subsoil. The soils have formed in slack-water sediment deposited in the headwaters of the major streams of the county and along those streams. They occur with the moderately well drained Middlebury and the somewhat poorly drained to poorly drained Holly soils on similar parent material.

Hemlock, spruce, rhododendron, and sphagnum moss were the native vegetation under which the Papakating soils have formed.

Only one soil of this series, Papakating silty clay loam, was mapped in Carbon County.

Typical profile (Papakating silty clay loam, in a level area, idle):

A_{11} 0 to 5 inches, very dark brown (10YR 2/2), mucky silty clay loam; weak, fine, granular structure; many roots; strongly acid (pH 5.0); gradual, wavy lower boundary; layer ranges from 3 to 7 inches in thickness within a distance of a few feet.

A_{12} 5 to 12 inches, very dark gray (10YR 3/1), mucky silty clay loam; common, fine and prominent, strong-brown (7.5YR 5/8) lines along root channels; weak, fine, granular structure; friable when moist, nonsticky when wet; some fragments of roots and stems; very strongly acid (pH 4.8); clear, wavy lower boundary; layer ranges from 6 to 8 inches in thickness within a distance of a few feet.

C_{1g} 12 to 22 inches, gray (N 5/0) silty clay loam; common, fine, prominent lines and streaks of yellowish red (5YR 4/8) along root channels; structureless (massive); plastic, nonsticky when wet; very strongly acid (pH 4.8); gradual, wavy lower boundary; layer ranges from 8 to 12 inches in thickness within a distance of a few feet.

C_{2g} 22 to 26 inches, gray (N 6/0) silty clay loam; common, coarse, prominent mottles of reddish yellow (5YR 6/8) and a few, coarse, prominent mottles of bluish gray (5B 5/1); structureless (massive); plastic, nonsticky when wet; strongly acid (pH 5.2); gradual, wavy lower boundary; layer ranges from 3 to 6 inches in thickness within a distance of a few feet.

C_{3g} 26 to 38 inches, dark-gray (N 4/0) silty clay loam with areas of dark-gray (5YR 4/1) sandy clay loam ¼ to ½ inch in diameter; structureless (massive); plastic, nonsticky; neutral (pH 6.6).

The A horizon ranges in thickness from 6 to 16 inches, and in texture, from silt loam to silty clay loam. The C horizon is generally silty clay loam, and the lower substratum ranges from silty clay loam to sandy clay loam or gravelly clay loam. Bedrock is generally at a depth of 15 feet, but the depth ranges from 4 to 30 feet.

The Papakating soils are very slowly permeable. Internal drainage is very slow, and the available moisture-holding capacity is moderate. The soils are naturally strongly acid.

Papakating silty clay loam (Pa).—The profile of this soil is like the one described as typical for the series. Included are a few stony and bouldery areas, some poorly drained areas, and areas of locally ponded sediments on Broad Mountain.

A high water table and the fine-textured, dense layers make this soil too wet for farming. Where the soil can be drained, shallow-rooted crops can be grown. Closely spaced bedding and open ditches are used in some areas. Permanent hay or pasture should consist of birdsfoot trefoil and reed canarygrass, which are suitable for wet soils. The soil should not be grazed or trampled when wet.

Lime and fertilizer, applied according to the needs indicated by soil tests, will increase the yields of forage. (Capability unit VIw–1; woodland suitability group 13.)

Pekin Series

The Pekin series consists of moderately well drained to somewhat poorly drained, medium- to fine-textured soils on stream terraces. The plow layer is dark grayish brown, and the subsoil is yellowish brown, distinctly mottled with strong brown. These soils have formed on stream terraces in alluvium deposited by streams before the last glacial period. The alluvium washed from areas consisting mainly of acid siltstone, shale, sandstone, and old glacial till.

The Pekin soils are the only ones mapped in Carbon County that have formed from this kind of parent material. They occur near the Conotton soils, which are on gravelly outwash of a later period. The native vegetation consisted of elm, ash, and hemlock.

Only one soil of this series, Pekin silt loam, 0 to 3 percent slopes, was mapped in Carbon County.

Typical profile (Pekin silt loam in a level area, idle):

A_p 0 to 8 inches, very dark grayish-brown to dark grayish-brown silt loam; weak, fine to medium, granular structure; very friable when moist, slightly sticky when wet; many roots; moderately acid (pH 5.7); abrupt, smooth lower boundary; layer ranges from 7 to 9 inches in thickness within a distance of a few feet.

B_1 8 to 16 inches, yellowish-brown (10YR 5/6) silt loam; moderate, medium, subangular blocky structure; thin, discontinuous clay films on peds; firm when moist, sticky when wet; no roots; moderately acid (pH 5.8); gradual, wavy lower boundary; layer ranges from 3 to 7 inches in thickness within a distance of a few feet.

B_{21g} 16 to 21 inches, yellowish-brown (10YR 5/6) to strong-brown (7.5YR 5/6) silty clay loam; common, medium, distinct mottles of light brownish gray (10YR 6/2); moderate, medium to coarse, blocky structure, slightly prismatic; thin streaks of sand; thin, discontinuous clay films on peds; firm when moist, sticky when wet; moderately acid (pH 5.8); clear, wavy lower boundary; layer ranges from 4 to 6 inches in thickness within a distance of a few feet.

B_{22g} 21 to 30 inches +, strong-brown (7.5YR 5/6) silty clay; common, coarse, prominent mottles of grayish brown (2.5Y 5/2); weak, medium, platy structure, tending

to massive; thin, continuous clay films on peds; hard when dry, very firm when moist, and sticky when wet; strongly acid (pH 5.3).

The texture of the surface soil ranges from fine sandy loam to silt loam; that of the subsoil varies slightly in amount of clay. Depth to stratified sand, silt, clay, and gravel ranges from 40 to 70 inches, depending on the manner of deposition. Bedrock is at a depth of 4 to 15 feet. Natural lime was not found in the subsoil.

Runoff and internal drainage are very slow, and permeability is slow. The moisture-holding capacity is low. Drainage from higher areas saturates the soil part of the time. The soil is strongly acid.

Pekin silt loam, 0 to 3 percent slopes (PkA).—The profile of this soil is like the one described as typical of the Pekin series.

This soil is well suited to cultivation if it has been drained. Open ditches, bedding, or a system of closed drains are needed to remove excess moisture. All the usual crops, but the deep-rooted ones, can be grown. The soil is well suited to permanent hay or pasture. Lime and fertilizer should be applied according to the needs indicated by soil tests and the crop to be grown. The use of winter cover crops will improve the soil tilth. To avoid compaction and sealing of the surface layer, the soil should not be worked or grazed for several days after rains. (Capability unit IIw-2; woodland suitability group 3.)

Riverwash

Riverwash (Ra).—This miscellaneous land type consists of islands of rounded cobbles and stones in the Lehigh River. It also consists of areas of similar material in the Lehigh River attached to the banks of the stream. Included are areas of severely gouged Holly silt loam, from which much of the profile has been lost.

Riverwash has been built up by the deposit of coarse, waterborne material, which has little or no soil material in it. The material is constantly exposed to flooding so that vegetation has but little chance of survival. Clumps of river birch, alder, and willow have survived in some places. (Capability unit VIIIs–1; woodland suitability group 12.)

Riverwash, coal (Rc).—This miscellaneous land type consists of very fine particles of coal, slate, and shale deposited along creeks and streams in the vicinity of coal-breakers. It consists also of coarse material deposited by water on the slopes below breakers or where breakers once stood. Most areas are fairly small, but the presence of this material is detrimental.

Riverwash, coal, clogs stream channels and pollutes the water with acid and sediment. Where it covers the soil, vegetation is killed and prevented from seeding. At most, only a few gray birch trees have survived. (Capability unit VIIIs–1; woodland suitability group 12.)

Rushtown Series

The Rushtown series consists of well-drained, well-aerated, droughty soils that have a thin, dark grayish-brown surface layer and a yellowish-brown, shaly subsurface layer. Below this is mainly shale coated with silt and clay deposited by alluvial or colluvial action. The chips of shale are fairly uniform in size and in their orientation to each other and to the slope.

These soils have formed in material from deep, fine shale on a small acreage in Lower Towamensing Township. In this county they are the only soils formed in this material. The native vegetation was white ash, white pine, scarlet oak, and black oak.

Typical profile (Rushtown shaly silt loam, 20 percent slopes, wooded):

- A_0 ½ inch to 0, black (10YR 2/1) organic layer consisting of decomposed leaf litter, mostly from deciduous trees; strongly acid; clear, smooth lower boundary; layer ranges from ¼ inch to 1 inch in thickness within a distance of a few feet.
- A_1 0 to 3 inches, dark grayish-brown (10YR 4/2) shaly silt loam; 40 percent of mass is shale fragments; weak, fine, granular structure; very friable when moist; many roots; strongly acid; clear, wavy lower boundary; layer ranges from 2 to 4 inches in thickness within a distance of a few feet.
- AC 3 to 14 inches, yellowish-brown (10YR 5/8) very shaly silt loam; 65 percent of mass is shale fragments; weak, fine to medium, granular structure; friable when moist; strongly acid; clear, irregular lower boundary; layer ranges from 8 to 14 inches in thickness within a distance of a few feet.
- C_1 14 to 40 inches, shale fragments with many coatings of silt and clay; strongly acid.
- C_2 40 inches to 15 feet, shale fragments with few coatings of silt and clay; strongly acid.
- D 15 feet +, bedrock consisting of thin-bedded siltstone and shale.

Some Rushtown profiles contain one or two layers of firm shaly silt loam, ranging from ½ inch to 1½ inches in thickness. These layers are mottled, firm, and roughly parallel to the surface. Above them are whorls of shale fragments, which are believed to have resulted from glacial frost action (*5*, *6*). These fragments are mainly 1/16 of an inch thick and ⅜ of an inch in diameter, but they may be as much as 2 inches in diameter. A few scattered quartzitic rocks, up to 8 inches in diameter and containing clear quartz crystals, occur in some places. Depth to shale bedrock ranges from 3 to 14 feet.

Rushtown soils have very low available moisture-holding capacity. They are strongly acid. Permeability, internal drainage, and the leaching of plant nutrients are all very rapid.

Rushtown shaly silt loam, 3 to 8 percent slopes (RsB).—This soil lacks an organic surface layer, but it has a dark grayish-brown plow layer. Except for these characteristics, it has a profile like the one described as typical of the Rushtown series.

Organic matter is quickly depleted in this soil because of the good aeration. Leaching of plant nutrients and droughtiness are major problems. The soil is suited to spring and winter grains. It is not well suited to crops that mature in fall. Erosion is a minor problem, but contour cultivation should be practiced to increase the absorption of moisture.

Organic matter needs to be added to this soil through the growing of green-manure crops and the use of long cropping systems that include several years of hay. Lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit IIIe–4; woodland suitability group 9.)

Rushtown shaly silt loam, 8 to 15 percent slopes (RsC).—The profile of this soil is similar to the one described as typical of the series, except that it has a dark grayish-brown plow layer.

Because of droughtiness, shallowness, slope, and the hazard of erosion, this soil is best suited to permanent hay. Birdsfoot trefoil is suited because it can tolerate dryness. Alfalfa may grow well if fertilized heavily enough. For best yields, lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit IVe–3; woodland suitability group 10.)

Rushtown shaly silt loam, 15 to 25 percent slopes (RsD).—The profile of this soil is like the one described as typical of the Rushtown series. Included are a few areas that have a dark grayish-brown plow layer.

Because of shallowness, droughtiness, strong slopes, and the hazard of erosion, Rushtown shaly silt loam, 15 to 25 percent slopes, is better suited to pasture than to tilled crops. Birdsfoot trefoil is the forage plant best suited to pasture. Lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit VIe–2; woodland suitability group 10.)

Rushtown shaly silt loam, 25 to 35 percent slopes (RsE).—The profile of this soil is similar to the typical profile, except that bedrock may be at a shallower depth.

Because of the steep slopes and the difficulty of working on this soil, the areas are better suited to trees than to pasture or tilled crops. Larch, black locust, and red and white pines are good species to grow for wood products. (Capability unit VIIe-1; woodland suitability group 11.)

Shelmadine Series

The Shelmadine soils are in two geographic areas—in the mountains and on low shale ridges in the southern part of the county. Those in the mountains are somewhat coarser textured than those on the low shale ridges.

These soils are poorly drained. They consist of light-brown or gray loam or heavy silt loam mottled with strong brown and brown. In most places the subsoil is heavy and is slightly plastic. The soils have formed in mixed parent material derived from glacial till, colluvium, and local rocks. In the mountains the mixture is mainly sandstone and siltstone. At lower elevations the sandstone is mixed with more siltstone and shale from local formations.

The Shelmadine soils are level to gently sloping. On the low shale ridges, they are below the Comly, Hartleton, Alvira, Watson, and Allenwood soils. In the mountains they are below the Alvira, Drifton, and Hazleton soils.

The native vegetation under which the Shelmadine soils have formed consisted of hemlock, blackgum, and pin oak. The present woodlands consist of these species and of red maple.

Typical profile (Shelmadine very stony silt loam on a slope of 2 percent, wooded):

A_0 4 inches to 0, organic layer consisting of decomposed leaves, roots, and twigs bound together with roots; 25 percent of mass is stones as much as 8 inches in diameter; weak, fine, crumb structure; very strongly acid (pH 4.6); clear, wavy lower boundary; layer ranges from 2 to 6 inches in thickness within a distance of a few feet.

A_1 0 to 3 inches, very dark grayish-brown (10YR 3/2) loam; 20 percent of mass is stones up to 8 inches in diameter; weak, fine, granular structure; friable when moist, slightly sticky when wet; few roots; very strongly acid (pH 4.8); clear, wavy lower boundary; layer ranges from 2 to 4 inches in thickness within a distance of a few feet.

A_2 3 to 7 inches, gray (10YR 5/1 to 6/1) silt loam; 15 percent of mass is coarse fragments; weak, medium, platy structure; friable when moist, sticky and slightly plastic when wet; very strongly acid (pH 4.8); clear, wavy lower boundary; layer ranges from 2 to 5 inches in thickness within a distance of a few feet.

B_{2g} 7 to 15 inches, light brownish-gray (2.5Y 6/2), heavy silt loam; moderate, medium, prominent mottles of strong brown (7.5YR 5/6); 15 percent of mass is coarse fragments; weak, thick, platy structure; thin, discontinuous clay films on peds; friable to firm when moist, sticky and slightly plastic when wet; very strongly acid (pH 5.0); gradual, wavy lower boundary; layer ranges from 6 to 10 inches in thickness within a distance of a few feet.

B_{3g} 15 to 27 inches, brown (7.5YR 5/2) loam; moderate, medium, distinct mottles of strong brown and brown (7.5YR 5/6 and 5/4); 10 percent of mass is coarse fragments; weak, thick, platy structure, tending to massive; thin, discontinuous clay films on peds; firm when moist, hard when dry; moderately acid (pH 5.7); clear, wavy lower boundary; layer ranges from 10 to 14 inches in thickness within a distance of a few feet.

C_g 27 inches +, dark grayish-brown to dark-brown (10YR 4/2 to 4/3) loam; common, medium, prominent mottles of brown to strong brown (7.5YR 5/4 and 5/8); 5 percent of mass is coarse fragments; massive; streaks of black manganese and iron; very firm when moist, very hard when dry; moderately acid (pH 5.7).

The surface layer of the Shelmadine soils ranges from fine sandy loam to heavy silt loam in texture. The subsoil is heavier textured than the surface layer. It has a texture of loam, sandy clay loam, or silty clay loam. The areas that have the finest texture overlie soft shale and siltstone formations. The dominant hue is 10YR, but the range is from 7.5YR to 2.5Y. Parent material is generally at a depth of 30 inches, but the depth ranges from 24 to 40 inches. Bedrock is at a depth of 3 to 20 feet.

Permeability and internal drainage are slow in these soils. Leaching of plant nutrients is slow, although the soils are low in natural fertility. The available moisture-holding capacity is moderate, but moisture is at field capacity about half the year. The soils are naturally strongly acid.

Shelmadine silt loam, 0 to 3 percent slopes (ShA).—This soil is mainly in the valleys of Mahoning and Big Creeks. It has a grayish-brown plow layer. It is free of stones and is shallower to bedrock and finer textured than the soil described as typical of the Shelmadine series. In most areas this soil has formed from shale and siltstone. Included are a few wooded areas.

Because of the poor drainage, this soil is better suited to permanent hay or pasture than to tilled crops. If drainage is provided, some of the moisture-tolerant, shallow-rooted crops may be grown. Bedding or shallow ditching are needed to remove excess water and allow field operations at the right time. Pastures or meadows should be seeded to shallow-rooted legumes, and lime and fertilizer applied in proper amounts. Trampling and grazing when the soil is wet may damage the structure of the soil. (Capability unit IVw–1; woodland suitability group 4.)

Shelmadine silt loam, 3 to 8 percent slopes, moderately eroded (ShB2).—This soil is similar to Shelmadine silt loam, 0 to 3 percent slopes, except that the surface layer is heavier textured because it has been mixed with subsoil. Runoff and the hazard of erosion are also greater. Most of this soil is around hillside springs.

This soil is better suited to permanent hay or pasture than to tilled crops. Rye and buckwheat or tomatoes can

be grown if the soil has been drained. Closed drains and diversion terraces are needed to remove excess water. Pastures or meadows ought to be seeded to birdsfoot trefoil, reed canarygrass, or ladino clover for best results. Lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit IVw–1; woodland suitability group 4.)

Shelmadine very stony silt loam, 0 to 8 percent slopes (SmB).—The profile of this soil is like the one described as typical of the Shelmadine series. It includes a few, small, nonstony areas that are in Penn Forest Township. Except for these areas, the soil is too stony for farming, and it is only fairly to moderately well suited to trees. Hemlock and red maple grow better than other kinds of trees on this soil. Woodlands can be improved by thinning and harvesting the mature trees and by favoring the species that are best suited to moist soils. (Capability unit VIIs–1; woodland suitability group 4.)

Strip Mines

Strip mines (Sr).—This miscellaneous land type is in the trough formed by steeply dipping formations of hard conglomerate and sandstone. It consists of alternate areas of coal-bearing formations and of sandstone, siltstone, and conglomerate rocks. The coal has been or is being removed from the coal-bearing formations. There are also scattered spoil banks that contain rocks and soil material. Deep pits, at times filled with water, are in the areas. Included are a few small, undisturbed areas of Hazleton, Drifton, and Fleetwood soils.

Strip mines consists both of areas where strip-mining operations are active and where they are inactive. Some of the inactive areas have a cover of gray birch on them. Very few stripped areas have been planted to trees, but many of them are suitable for pine, locust, larch, or shrubs. The limitations of this land type are severe runoff, stoniness, acidity, infertility, and compact surface. (Capability unit VIIIs–1; woodland suitability group 12.)

Swartswood Series

The Swartswood series consists of uniform, medium- to coarse-textured, deep, well-drained soils. The soils have a dark-brown to grayish-brown, mineral surface layer and a yellowish-brown to strong-brown subsoil. The structure is weakly developed. A moderate, but distinct, pan is at a depth of 24 to 36 inches.

Swartswood soils have formed in recent glacial till consisting of gray sandstone, siltstone, and conglomerate. The till is from 3½ to 20 feet deep and is in Kidder Township. Nearly all of the acreage is stony and is wooded, but small areas have been cleared and farmed.

Northern hardwoods and some mixed oaks and pines originally grew on the Swartswood soils. The present woodlands consist mostly of red maple, white oak, gray birch, sassafras, and aspen.

The Swartswood soils are adjacent to and above the moderately well drained Wurtsboro, the somewhat poorly drained to poorly drained Volusia, and the very poorly drained Lickdale and Tughill soils. In most places they are below the shallow to moderately deep Lordstown soils. All of these soils have formed on similar gray glacial material.

Typical profile (Swartswood very stony loam, on a slope of 6 percent, in a wooded area):

- A_0 1 inch to 0, black (N 2/0) mor-type organic layer; 40 percent of mass is coarse fragments up to 2 feet in diameter; weak, very fine, granular structure; very friable when moist; many fine roots; extremely acid (pH 4.4); abrupt, smooth lower boundary; layer ranges from ½ inch to 1½ inches in thickness.
- A_2 0 to 4 inches, brown to dark-brown (7.5YR 5/2 to 4/2), light loam; 30 percent of mass is coarse fragments up to 6 inches in diameter; weak, thin, platy structure; friable when moist; some coarse and fine roots; extremely acid (pH 4.5); abrupt, smooth lower boundary; layer ranges from 3 to 5 inches in thickness within a distance of a few feet.
- B_{ir} 4 to 5 inches, dark-brown (7.5YR 4/4 to 3/2) silt loam; weak, fine, granular structure; very friable when moist; numerous roots; extremely acid (pH 4.5); clear, irregular lower boundary; layer ranges from ¼ inch to 2 inches in thickness within a distance of a few feet.
- B_1 5 to 11 inches, strong-brown (7.5YR 5/6) loam; 10 percent of mass is coarse fragments up to 6 inches in diameter; weak, fine, subangular blocky structure; numerous coarse and fine roots; friable when moist; very strongly acid (pH 5.0); clear, wavy lower boundary; layer ranges from 5 to 8 inches in thickness within a distance of a few feet.
- B_{21} 11 to 19 inches, strong-brown (7.5YR 5/6) loam; 30 percent of mass is coarse fragments up to 6 inches in diameter; weak to moderate, fine to medium, subangular blocky structure; thin, discontinuous clay films on peds; numerous roots; friable when moist; strongly acid (pH 5.1); clear, wavy lower boundary; layer ranges from 5 to 10 inches in thickness within a distance of a few feet.
- B_{22} 19 to 26 inches, strong-brown (7.5YR 5/6) loam; 30 percent of mass is coarse fragments up to 6 inches in diameter; weak, medium, subangular blocky structure; thin, discontinuous clay films on peds, thick films in pores; friable when moist; some roots; very strongly acid (pH 4.8); gradual, irregular lower boundary; layer ranges from 3 to 9 inches in thickness within a distance of a few feet.
- B'_{2m} 26 to 35 inches, strong-brown (7.5YR 5/6) fine sandy loam; 30 percent of mass is coarse fragments up to 6 inches in diameter; weak to moderate, thin to medium, platy structure; thin, discontinuous clay films on peds, thick in pores; very firm when moist; fragipan horizon; few roots; very strongly acid (pH 4.9); gradual, wavy lower boundary; layer ranges from 7 to 12 inches in thickness within a distance of a few feet.
- C_1 35 to 60 inches, brown (7.5YR 5/4) sandy loam; 50 percent of mass is coarse fragments up to 12 inches in diameter; thin, discontinuous clay films in pores at top of layer; firm when moist.
- C_2 60 inches +, till.

The Swartswood soils range in hue from 10YR to 5YR, but mainly they have hues of 7.5YR. The texture may be silt loam or sandy clay loam, and the consistence may be sticky, where shale or siltstone is present. The A_2 horizon ranges from only a trace to 5 inches in thickness. Bedrock is commonly at a depth of 10 feet, but the depth ranges from 3½ to 20 feet.

Permeability is moderately rapid above the pan, and moderately slow through it. The available moisture-holding capacity is moderate to low. The soils are very strongly acid.

Swartswood channery silt loam, 0 to 8 percent slopes (SsB).—The plow layer of this soil is very dark grayish brown and consists of a mixture of surface soil, part of the A_2 layer, and part of the subsoil. Most of the stones have been removed from the surface, and only a few of the channery fragments remain. These fragments, however,

interfere slightly with tillage. Except for these differences the profile of this soil is similar to the one described as typical for the Swartswood series. Included are some uneroded and slightly eroded areas that have a few stones on the surface.

Swartswood channery silt loam, 0 to 8 percent slopes, is suited to most crops grown locally, including small grains, hay, and pasture. It is well suited to spinach, cabbage, potatoes, and other cool-season crops. Contour tillage, rotation of crops, and winter cover crops are needed to protect the soil from erosion, Diversion terraces may be needed to divert runoff from higher areas. The growing season is fairly short, and the temperatures are cool. (Capability unit IIe–2; woodland suitability group 1.)

Swartswood channery silt loam, 8 to 15 percent slopes, moderately eroded (SsC2).—The characteristics of this soil are like those of Swartswood channery silt loam, 0 to 8 percent slopes. Otherwise, the profile is like the one described for the series. Surface runoff is moderately high on this soil.

This soil is suited to most of the crops grown locally, including small grains, hay, and pasture. Diversion terraces are needed, as the hazard of erosion is severe. Stripcropping, winter cover crops, and grassed waterways should also be used to protect the soil. Lime and fertilizer, applied according to the needs indicated by soil tests, will keep productivity high. (Capability unit IIIe–2; woodland suitability group 2.)

Swartswood very stony loam, 0 to 8 percent slopes (SwB).—The profile of this soil is like the one described as typical of the Swartswood series. Some of the areas have large stones and boulders on the surface. Included are areas of moderately well drained and of moderately deep soils.

All of Swartswood very stony loam, 0 to 8 percent slopes, is wooded and is too stony for cultivation. It is suited to pasture and trees. Red maple and oak grow well on this soil. Stoniness interferes in some places with the natural reseeding of trees. Construction of fire lanes and other practices to protect the areas from fire are needed. (Capability unit VIs–1; woodland suitability group 1.)

Swartswood very stony loam, 8 to 25 percent slopes (SwD).—The profile of this soil is like the one described as typical for the series, except that in places it is somewhat shallower over bedrock. In addition, the fragipan is less well expressed. Runoff is moderate because of the pan. Included are extremely stony areas and those in which there are stone stripes.

Swartswood very stony loam, 8 to 25 percent slopes, is too stony for cultivation and is suited to pasture or trees. Stoniness and the moderate moisture-holding capacity interfere with the growth of plants. Woodland borders and fire lanes and other means of preventing fire are needed to improve the condition of the woodlands. (Capability unit VIs–1; woodland suitability group 2.)

Tioga Series

The Tioga series is made up of deep, well-drained soils on flood plains. The profile generally consists of 18 to 30 inches of dark-brown, uniformly fine-textured soil over stratified soil material.

These soils are mostly along the Lehigh River and Aquashicola Creek, but small, spotty areas are along other streams. The soils have formed from material carried in suspension by streams and deposited during periods of overflow. This material was washed from glaciated uplands that consisted mostly of acid rocks.

The Tioga soils are near, but above, the moderately well drained Middlebury soils and the somewhat poorly drained to poorly drained Holly soils. All of these soils have formed from similar parent material. The Tioga soils are seldom flooded, except when streams are at extreme flood stage. They have developed under native forests consisting of hemlock, hickory, ash, basswood, and poplar.

Typical profile (Tioga silt loam, 0 to 3 percent slopes, in a cultivated field):

- A_p 0 to 9 inches, dark-brown (10YR 3/3) silt loam; weak, fine, granular structure; very friable; many roots; moderately acid (pH 6.0); abrupt, wavy lower boundary; layer ranges from 8 to 10 inches in thickness within a distance of a few feet.
- AC 9 to 18 inches, dark-brown (7.5YR 4/4) silt loam; weak to moderate, fine to medium, blocky structure breaking to weak, fine, subangular blocky; very thin films of clay or clay and organic matter on peds in upper 5 inches; friable when moist, slightly plastic when wet; common roots and pores; slightly acid (pH 6.2 to 6.4); clear, wavy lower boundary; layer ranges from 8 to 10 inches in thickness within a distance of a few feet.
- C_1 18 to 23 inches, dark-brown (7.5YR 4/4) very fine loam; weak, medium, blocky structure with a tendency to platiness; very friable when moist; common roots and pores; slightly acid (pH 6.3); clear, wavy lower boundary; layer ranges from 4 to 6 inches in thickness within a distance of a few feet.
- C_2 23 to 31 inches, dark-brown (7.5YR 4/2 to 4/4) very fine sandy loam; very weak, coarse, blocky structure with a tendency to platiness; very friable when moist; common, fine roots; slightly acid (pH 6.3); clear, wavy lower boundary; layer ranges from 7 to 9 inches in thickness within a distance of a few feet.
- D 31 to 35 inches +, dark-brown (10YR 4/3) sand; slightly acid (pH 6.1).

The surface layer of the Tioga soils is silt loam or fine sandy loam. The texture in the rest of the profile depends mainly on the order in which the material was deposited. In places the deposits are as much as 20 feet thick. Gravelly and cobbly material is at a depth of 24 to 54 inches.

The Tioga soils are moderate to high in productivity and available moisture-holding capacity. They are rapid to moderately rapid in permeability and internal drainage.

Tioga fine sandy loam (Tf).—This soil is mainly along the Lehigh River and in spotty areas along other smaller streams. Its surface layer consists of about 13 inches of dark-brown fine sandy loam containing numerous wormholes. Below this is reddish-brown fine sandy loam, sandy loam, and sand, underlain by cobbles and pebbles at a depth of 60 inches. Some sediment has been deposited during floods.

This soil has moderate available moisture-holding capacity. Permeability and internal drainage are rapid, and the leaching of plant nutrients is moderately rapid.

Much of this soil is in townsites or is unavailable for cultivation because it is cut off by roads, railroads, and steep hills. The soil is suited to crops if it is adequately fertilized and given supplemental irrigation. (Capability unit I–1; woodland suitability group 1.)

Tioga silt loam (Tg).—The profile of this soil is like the one described as typical of the Tioga series.

This soil has moderate to high available moisture-holding capacity, and it is highly productive. Permea-

bility and internal drainage are moderately rapid. Leaching of plant nutrients is only moderate. The soil is slightly to moderately acid.

Except for infrequent flooding, this soil has no limitations that restrict the production of crops. Rotating crops and growing winter cover crops help to maintain the soil in good tilth. Lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit I–1; woodland suitability group 1.)

Tioga and Middlebury very stony loams, 0 to 8 percent slopes (TmB).—This undifferentiated mapping unit consists of well drained and moderately well drained, stony soils formed in alluvium. A few poorly drained areas, extremely stony areas, and areas that have been gouged by floods are also included.

The soils in this mapping unit are too stony and too frequently flooded for cultivation or pasture. Yellow birch, rhododendron, hemlock, and smaller woody plants grow to some extent, and this vegetation is suitable mainly for wildlife areas and watershed protection. (Capability unit VIIs–1; woodland group 3.)

Tughill Series

The Tughill series consists of moderately deep, very poorly drained soils in swamps. The soils have a surface layer of black mucky silt loam that is 6 to 18 inches thick. Below this is grayish mucky silt loam. The soils have formed in deep glacial till, consisting mainly of materials derived from gray sandstone with some materials from siltstone, shale, and conglomerate. The native vegetation is hemlock, black spruce, swamp blueberry, swamp alder, and sphagnum moss.

Almost all of the acreage of Tughill soils is in the mountainous part of the county. These soils are near the Hazleton, Drifton, Alvira, Shelmadine, Swartswood, Wurtsboro, and Volusia soils, all of which have formed from similar parent material.

Typical profile (Tughill very stony loam, 0 to 3 percent slope, wooded):

- A_1 0 to 12 inches, black (10YR 2/1), very stony, mucky silt loam high in organic matter; occasional conglomerate boulders up to 3 feet in diameter are on the surface; abrupt, smooth lower boundary; layer ranges from 11 to 13 inches in thickness within a distance of a few feet.
- A_{2g} 12 to 18 inches, gray (N 6/0), strongly gleyed silty clay loam; weak, medium, blocky structure tending to massive when moist; friable when moist, sticky and slightly plastic when wet; very strongly acid (pH 4.8); gradual, wavy lower boundary; layer ranges from 5 to 8 inches in thickness within a distance of a few feet.
- B_{2g} 18 to 30 inches, strong-brown (7.5YR 5/8) loam; wavy, medium, distinct mottles of yellowish brown (10YR 5/4) and light brownish gray (10YR 6/2); 5 percent of mass is stones up to 8 inches in diameter; massive; firm when moist, slightly sticky when wet; very strongly acid (pH 5.0).
- C_g 30 inches +, gray (N 5/0), strongly gleyed, unmottled stony loam.

In some places the A_1 layer ranges from 6 to 18 inches in thickness and is nonstony. However, in most areas of these soils, this layer is stony to extremely stony. Local alluvium, 3 to 8 inches thick, forms the upper part of some profiles. In some places the B_{2g} horizon is absent or is thin. The C_g horizon is generally at a depth of 18 to 36 inches and consists of stony or pebbly loam. Depth to bedrock ranges from 3 to 18 feet, but bedrock is commonly at a depth of about 12 feet.

Permeability, internal drainage, and leaching are all very slow in these soils. The soils have moderate moisture-holding capacity. Moisture is at field capacity about three-fourths of the year. The soils are very strongly acid.

In Carbon County the Tughill soils are mapped with Lickdale soils in undifferentiated mapping units that are listed under the Lickdale series. The Lickdale soils differ from the Tughill in having a heavier texture that consists of silt loam to silty clay loam in the lower part of the subsoil. The texture of this layer depends on the proportion of weathered shale, siltstone, or sandstone in the parent material. The Lickdale series is described briefly elsewhere in the report.

Tunkhannock Series

The Tunkhannock series consists of deep, well-drained, gravelly loams that have a dark reddish-brown to strong-brown, mineral surface layer and a yellowish-red or reddish-brown subsoil. Most of the soil profile has a coarse texture, but the subsoil contains a slight to moderate increase in clay, depending on the nature of the parent material.

The Tunkhannock soils developed south of the glacial front in Kidder Township. They formed in Wisconsin glacial outwash. This cobbly, gravelly, and sandy material is mixed with red and gray, stratified drift. In the vicinity of Weatherly and Penn Forest, the Tunkhannock soils have a fairly smooth relief, characteristic of the areas where sediment has been laid down by fast-moving water. In Kidder Township the relief is irregular and the landscape is dotted with swamps and bogs.

The native vegetation on the Tunkhannock soils was gray birch and red maple with lesser, varying amounts of white and chestnut oaks, sassafras, laurel, and greenbrier. These soils are now mostly wooded, but they are being developed extensively as sources of gravel and sand.

Typical profile (Tunkhannock gravelly loam, 8 to 15 percent slopes, in woodland):

- A_0 ¼ inch to 0 of very dark gray (7.5YR 3/1), well-rotted organic matter, mixed with some gravelly loam; weak, fine, granular structure; layer ranges from ¼ to ½ inch in thickness.
- A_2 0 to 2 inches, dark reddish-brown (5YR 3/3 to 3/4) cobbly sand; very weak, fine, granular structure; very friable when moist; strongly acid (pH 5.2); abrupt, wavy lower boundary; layer ranges from ½ inch to 2½ inches in thickness within a distance of a few feet.
- A_3 2 to 10 inches, strong-brown (7.5YR 5/6) sandy loam; moderate, thin to medium, platy structure; friable when moist; strongly acid (pH 5.1); clear, wavy boundary; layer ranges from 6 to 10 inches in thickness within a distance of a few feet.
- B_2 10 to 18 inches, yellowish-red (5YR 4/6 to 4/8) sandy loam to sandy clay loam with numerous pebbles; weak, fine, subangular blocky structure, breaking to weak, fine, granular; friable when moist; strongly acid (pH 5.2); clear, wavy lower boundary; layer ranges from 8 to 12 inches in thickness within a distance of a few feet.
- C 18 to 180 inches, reddish-brown (2.5YR 4/4) gravelly sand; streaks of sand coated with black manganese or iron; structureless; very friable when moist, slightly hard when dry; strongly acid (pH 5.1).

The colors range from hues of 7.5YR in the A horizon to 2.5YR in the C horizon. The texture of the C horizon ranges from loam to gravelly sandy loam, depending on

the way the layers of sand, silt, and gravel were deposited. Areas of gravelly sandy loam in the vicinity of Lake Harmony are 5 to 100 feet thick. In these areas the soils are more droughty than the other Tunkhannock soils.

The Tunkhannock soils are rapidly permeable and have a moderate to low moisture-holding capacity.

Tunkhannock gravelly loam, 0 to 3 percent slopes (TuA).—This soil has a profile similar to the one described as typical for the series, except that the subsoil contains a little more silt and clay. It is adjacent to small streams, and it occupies flat uplands. Included are areas that were formerly cultivated in which the uppermost 10 inches of the profile is very dark brown.

Tunkhannock gravelly loam, 0 to 3 percent slopes, is suited to all the crops grown locally, especially to the deep-rooted ones. It is well suited to potatoes, wheat, and alfalfa. In dry periods crops may be short on moisture. Contour farming and cover crops are needed to conserve moisture and improve the supply of organic matter. Lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit I–2; woodland suitability group 1.)

Tunkhannock gravelly loam, 3 to 8 percent slopes (TuB).—Except for the difference in slopes, this soil is similar to Tunkhannock gravelly loam, 8 to 15 percent slopes. Runoff is less of a hazard. Included are cultivated areas in which the uppermost 10 inches of the profile is dark reddish brown.

Potatoes, wheat, and alfalfa grow well on Tunkhannock gravelly loam, 3 to 8 percent slopes. During long, dry periods, however, the shallow-rooted crops are short on moisture. Stripcropping, cover crops, rotation of crops, and lime and fertilizer are needed to improve the soil and protect it from erosion. The lime and fertilizer should be applied according to the needs indicated by soil tests and according to the crops to be grown. (Capability unit IIe–1; woodland suitability group 1.)

Tunkhannock gravelly loam, 8 to 15 percent slopes (TuC).—The profile of this soil is like the one described as typical for the series. Included are small, moderately eroded areas. A few areas have been cultivated. In these areas the A horizon, unlike that described in the typical profile, is dark reddish brown to a depth of 8 to 15 inches. Some very poorly drained potholes dot the areas in Kidder Township. In these the soil is stonier than normal for Tunkhannock soils.

Tunkhannock gravelly loam, 8 to 15 percent slopes, is suited to all the crops grown in the county. In places runoff is high unless soil-conserving practices are used. Contour stripcropping, where practicable, a cropping system that includes 2 years of alfalfa, and cover crops or green-manure crops are needed to build up organic matter and hold moisture.

To improve yields, lime and fertilizer should be applied according to the needs indicated by soil tests. Terraces may be needed to divert excess water to safe outlets. (Capability unit IIIe–1; woodland suitability group 2.)

Tunkhannock gravelly loam, 15 to 25 percent slopes (TuD).—The profile of this soil is similar to the one described as typical for the series, except that it may contain more cobbles and gravel. This soil also has a lower moisture-holding capacity. Included are large areas with small potholes in which drainage is very poor. These potholes are between well-drained, hummocky areas. Also included are steep areas and moderately eroded areas with a few gullies. Much of this type of erosion occurs in Kidder Township and on benches or terraces elsewhere in the county.

Because of its good workability and light texture, Tunkhannock gravelly loam, 15 to 25 percent slopes, is suited to deep-rooted legumes and grasses or to trees. The main problems are steepness, low fertility, and moderately low moisture-holding capacity. This soil ought to be kept in close-growing vegetation most of the time, and row crops should be grown only occasionally. Large wooded tracts need to be thinned to favor the more valuable trees, and they ought to be protected from fire.

To improve crop yields, lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit IVe–1; woodland suitability group 2.)

Very Stony Land

The mapping units in this miscellaneous land type consist of stones, boulders, and outcrops of rock. The areas are too steep and stony for any use except shrubs and slow-growing trees. In places geologic erosion is keeping pace with the soil-forming processes.

Very stony land, 0 to 8 percent slopes (VeB).—This mapping unit consists of glacial blocks made up of stones and boulders ranging from 3 inches to as much as 10 feet in diameter. A notable example is Big Boulder Field in Hickory Run State Park (fig. 6). Most areas are only a few acres in size. Streams flow under these areas at a depth of 4 to 5 feet. Most areas at one time probably contained soil material, which has been lost through geologic erosion. (Capability unit VIIIs–1; woodland suitability group 12.)

Very stony land, 8 to 25 percent slopes (VeD).—This mapping unit is mainly on ridges. It consists of outcrops of resistant, hard rocks over formations of weaker material. A litter of numerous stones and boulders is on the surface. Included are small patches of shallow soil material on which a few trees and shrubs grow. (Capability unit VIIIs–1; woodland suitability group 12.)

Figure 6.—A nearly level, 30-acre field of glacial blocks in Hickory Run State Park.

Very stony land, 25 to 120 percent slopes (VeF).—Much of this mapping unit is on very steep slopes along the Lehigh River and its tributaries. In these locations are nearly vertical walls of rock formed through the erosion of streams; steep outcrops of rocks; bouldery areas interspersed with spots of shallow, stony soil; and talus slopes.

The rest of the mapping unit consists of very steep, rocky, mountain slopes. Examples of these areas are the Stony Ridges near Blue Mountain and in Penn Forest Township, Lake Mountain above Albrightsville, and the Pocono escarpment. (Capability unit VIIIs–1; woodland suitability group 12).

Volusia Series

The Volusia series consists of poorly drained to somewhat poorly drained very stony loams and silt loams on uplands. The soils are yellowish brown to light brownish gray. They are medium in texture to a depth of about 30 inches and are underlain by material that contains a moderate amount of sand. A strong fragipan is at a depth of 16 to 24 inches. Mottles, caused by seepage and the high water table, are at a depth below 5 inches.

The Volusia soils have formed in deep Wisconsin glacial till derived from gray, acid sandstone, siltstone, and shale with some quartzite. They are in the catena that includes the shallow to moderately deep, well drained Lordstown; the deep, well drained Swartswood; the deep, moderately well drained Wurtsboro; and the very poorly drained Lickdale and Tughill soils. Volusia soils are similar to the Morris soils, but the Morris soils formed on reddish material.

The native vegetation on the Volusia soils is red maple, gray birch, sassafras, mountain-laurel, rhododendron, hemlock, bigtooth aspen, brackenfern, mosses, and other ground plants. In most of the acreage, the soils are very stony and are in trees, but a small acreage is farmed. Part of the silt loam soil has been cleared of rocks but is still channery.

Typical profile (Volusia very stony loam, 0 to 8 percent slopes, wooded):

A_{00} 3 to 2 inches, deciduous leaf litter, slightly decomposed.

A_0 2 inches to 0, black (N 2/0), well-rotted organic matter mixed with some loam; numerous stones up to 10 inches in diameter; weak, fine, crumb structure; soft when dry, friable when moist; many roots; extremely acid (pH 4.3); clear, smooth lower boundary; layer ranges from 1 to 3 inches in thickness within a distance of a few feet.

A_2 0 to 3 inches, dark-gray (10YR 4/1) very stony sandy loam; when dry, gray (10YR 6/1); numerous stones up to 6 inches in diameter; weak, thin, platy and weak, fine, subangular blocky structure; loose when dry, friable when moist; many roots; extremely acid (pH 4.1); gradual, irregular lower boundary; layer ranges from 1 to 6 inches in thickness within a distance of a few feet.

A_3 3 to 9 inches, pale-brown (10YR 6/3) very stony silt loam; when dry light brownish gray (10YR 6/2); common, medium, distinct mottles of yellowish brown (10YR 5/6) and yellowish red (5YR 5/6); numerous stones up to 6 inches in diameter; moderate, thin, platy structure; hard when dry, friable when moist, slightly sticky when wet; some roots; extremely acid (pH 4.2); gradual irregular lower boundary; layer ranges from 3 to 9 inches in thickness within a distance of a few feet.

B_{1g} 9 to 12 inches, yellowish-brown (10YR 5/6); very stony, heavy silt loam; when dry, yellowish brown (10YR 5/4); common, fine, distinct mottles of yellowish red (5YR 5/6) and dark grayish brown (10YR 4/2); moderate, fine, blocky structure, which breaks to moderate, thin, platy; thin, discontinuous clay films on peds; slightly hard when dry, friable when moist, slightly sticky when wet; few roots; very strongly acid (pH 4.5); clear, wavy lower boundary; layer ranges from 2 to 4 inches in thickness within a distance of a few feet.

A'_{2g} 12 to 24 inches, yellowish-brown (10YR 5/6) stony sandy loam; when dry, pale brown (10YR 6/3); many, medium, prominent mottles of yellowish red (5YR 5/8) and light yellowish brown (2.5Y 6/4); moderate, medium, blocky to platy structure; thin, discontinuous clay films on peds; friable when moist; extremely acid (pH 4.4); clear, wavy lower boundary; layer ranges from 11 to 13 inches in thickness within a distance of a few feet.

B'_{2gm} 24 to 27 inches, light brownish-gray (2.5Y 6/2), stony, heavy silt loam; many, medium, prominent mottles of strong brown (7.5YR 5/8) and yellowish brown (10YR 5/6); moderate, medium, blocky structure; thin, continuous clay films on peds; firm when moist, slightly sticky when wet; very strongly acid (pH 4.6); clear, irregular lower boundary; layer ranges from 2 to 6 inches in thickness within a distance of a few feet.

C 27 inches +, light brownish-gray (2.5Y 6/2) stony loamy sand; common, medium, distinct mottles of strong brown (7.5YR 5/6) and yellowish brown (10YR 5/4); moderate to strong, thin, platy structure; very strongly acid (pH 4.6).

The Volusia soils on hummocks are better drained than those in depressions. Those in depressions have a thicker A_0 layer because of the accumulation of organic matter. The textures are very stony loam, extremely stony loam, stony silt loam, and silt loam. The colors are mainly hues of 10YR, but they range from 7.5YR to 2.5Y. The color of the dry soil is 1 to 2 units higher in value than that of moist soil. In a few places, the till is less than 10 feet thick, but it ranges from 3 to 20 feet or more in thickness.

The Volusia soils are moderately permeable to a depth of 12 inches or more and are very slowly permeable below that level. They have moderate to low available moisture-holding capacity.

Volusia silt loam, 0 to 8 percent slopes (VoB).—The profile of this soil is like the one described as typical for the Volusia series, except that the A_p horizon is dark grayish-brown (10YR 4/2) silt loam. Enough stones have been removed to allow the soil to be cultivated.

This soil occurs in the same general area and in the same position as Volusia very stony loam, 0 to 8 percent slopes. It is more accessible than that soil because most of it is near roads. Included with it are moderately sheet eroded, level and gently sloping areas.

Volusia silt loam, 0 to 8 percent slopes, is wet and has a shallow root zone and a low moisture-holding capacity. It is suitable for cultivation and for pasture or hay. Extensive drainage through the use of terraces, waterways, and underground drains is needed to improve the soil. Lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit IIIw–1; woodland suitability group 4.)

Volusia very stony loam, 0 to 8 percent slopes (VsB).—The profile of this soil is like the one described as typical for the Volusia series. This soil is at the bases of slopes or on flat areas in the western half of Kidder Township.

Included are small areas of stony silt loam and of extremely stony loam.

Volusia very stony loam, 0 to 8 percent slopes, is stony and wet, but it is suited to trees or pasture. Nearly all of the acreage is woodland.

The wetness, stoniness, shallow root zone, and low moisture-holding capacity of this soil restrict the growth of plants. The soil should be managed for forestry and recreation, and the vegetation, for watershed protection. Fire protection, thinning, and improved cutting are practices that are needed. (Capability unit VIs–4; woodland suitability group 4.)

Watson Series

The Watson series consists of deep, reddish soils that have distinct brown and gray mottles in the lower part of the subsoil. The uppermost layers in the profile are friable, but the layers at a depth of 20 to 24 inches are firm. The Watson soils have formed in deep, acid glacial till derived from red and yellow shale, siltstone, fine sandstone, and quartzite. They occur with the well-drained Allenwood, the somewhat poorly drained Alvira, the poorly drained Shelmadine, and the very poorly drained Norwich soils. The Watson soils are finer textured than the Albrights soils.

The Watson soils have formed under forests of white pine, hemlock, mixed oak, and maple. Most of the acreage is pastured or in cultivation.

Typical profile (Watson silt loam on a slope of 3 percent, pastured, slightly eroded):

A_p 0 to 8 inches, dark reddish-brown (5YR 3/4) silt loam; weak, fine, granular structure; friable when moist; many roots; neutral (pH 6.6); abrupt, smooth lower boundary; layer ranges from 7 to 9 inches in thickness within a distance of a few feet.

B_1 8 to 12 inches, reddish-brown (5YR 5/4), light silty clay loam; weak, thin, platy structure to subangular blocky; thin, discontinuous clay films on peds; friable when moist, slightly plastic when wet; some roots; slightly acid (pH 6.4); clear, wavy lower boundary; layer ranges from 2 to 6 inches in thickness within a distance of a few feet.

B_{21} 12 to 18 inches, reddish-brown (5YR 5/4) to yellowish-red (5YR 5/6), light silty clay loam; weak, fine to medium, subangular blocky structure; thick clay films on peds; friable when moist, slightly plastic when wet; some roots; slightly acid (pH 6.2); clear, wavy lower boundary; layer ranges from 4 to 8 inches in thickness within a distance of a few feet.

B_{22g} 18 to 22 inches, red (2.5YR 4/6) silty clay loam; few, fine, faint mottles of strong brown (7.5YR 5/6); weak to moderate, medium, subangular blocky structure; thick clay films on peds; firm when moist, slightly plastic when wet; few roots along polygon faces; slightly acid (pH 6.2); clear, wavy lower boundary; layer ranges from 3 to 7 inches in thickness within a distance of a few feet.

B_{23g} 22 to 30 inches, red (2.5YR 4/6) silty clay loam; few, fine, faint (some coarse) mottles of strong brown (7.5YR 5/6); weak polygons, breaking to moderate, fine and medium, blocky structure; thick clay films on peds; firm when moist, plastic when wet; few, fine roots along polygon faces; moderately acid (pH 5.8); gradual, wavy lower boundary; layer ranges from 6 to 10 inches in thickness within a distance of a few feet.

B_{24g} 30 to 36 inches, red (2.5YR 4/6), light silty clay loam; 20 percent of mass is gravel; few, coarse, distinct mottles of strong brown (7.5YR 5/8); very coarse structure breaking to moderate, medium, blocky; thick clay films on peds; firm when moist, moderately plastic when wet; few, fine roots along polygon faces; strongly acid (pH 5.4); clear, wavy lower boundary; layer ranges from 4 to 8 inches in thickness within a distance of a few feet.

B_{3g} 36 to 41 inches, red (2.5YR 5/6) silt loam; 25 percent of mass is gravel; few, coarse, distinct mottles of strong brown (7.5YR 5/8); polygons with moderate, thin to medium, platy structure; thick clay films on peds and pebbles; firm when moist, slightly plastic when wet; few, fine roots along polygon faces; strongly acid (pH 5.4); clear, wavy lower boundary; layer ranges from 4 to 7 inches in thickness within a distance of a few feet.

C_{1g} 41 to 53 inches, red (2.5YR 5/6), light silt loam; 40 percent of mass is gravel; common, coarse, distinct mottles of strong brown (7.5YR 5/8); weak, thin to medium, platy structure; firm when moist; strongly acid (pH 5.2).

The texture of the Watson soils ranges from silt loam to silty clay loam. The color ranges from hues of 2.5YR to 10YR. The structure ranges from subangular blocky to blocky or platy; polygons are absent in some profiles. In most places the firm horizon is a weak fragipan, but in places there is a moderate fragipan where the parent material contains more sand. The solum ranges from 24 to 50 inches in thickness and overlies parent material that is 4 to 20 feet thick.

Permeability is slow to moderately slow in these soils, and the available moisture-holding capacity is moderate to moderately high. The soils are naturally strongly acid.

Watson gravelly silt loam, 0 to 8 percent slopes, moderately eroded (WaB2).—The profile of this soil is more yellowish and more gravelly than the one described as typical for the Watson series. Included are some slightly eroded, level to gently sloping areas and wooded areas with stones on the surface. Also included are occasional shallow potholes containing poorly drained and very poorly drained soils. In addition, there is an area of very deep till that has a texture of silt loam in a moraine of Illinoian glacial age near Palmerton.

Watson gravelly silt loam, 0 to 8 percent slopes, moderately eroded, is suited to most crops commonly grown in the county, except some of the deep-rooted ones. Surface drainage and, in some places, closed drains are needed to dispose of excess water. Contour farming, stripcropping, and diversion terraces are needed to control erosion and runoff.

To improve the yields of crops, lime and fertilizer should be applied according to the needs indicated by soil tests. Tilling the soil when wet breaks down its structure and causes the subsoil to become hard. Cover crops and hay, included in the cropping system, are sources of organic matter needed to keep the soils permeable to air, roots, and water. (Capability unit IIe–4; woodland suitability group 3.)

Watson silt loam, 0 to 3 percent slopes (WsA).—The profile of this soil is like the one described as typical for the Watson series, except that it has a dark reddish-brown to dark reddish-gray plow layer. The difference in color has been caused by its more nearly level position and consequent retention of water for longer periods of time. Included are small, moderately eroded areas. Also included are areas that have not been plowed or pastured. These have a thin, black surface layer, about 3 inches thick, and a light reddish-brown subsurface layer, about 5 inches thick.

Watson silt loam, 0 to 3 percent slopes, has moderate internal drainage and slow runoff. Leaching of plant nutrients is slow.

Excess water and frost pockets are hazards to plant growth on this soil. A combination of open ditches, diversion terraces, and closed drains is needed to remove excess moisture. If lime and fertilizer are applied in proper amounts, the crops commonly grown in the county, except the deep-rooted ones, will produce high yields in most years. (Capability unit IIw–2; woodland suitability group 3.)

Watson silt loam, 3 to 8 percent slopes, moderately eroded (WsB2).—The profile of this soil is like the one described as typical of the Watson series. Included are small areas having a black surface layer, 3 inches thick, underlain by a light reddish-brown horizon.

Watson silt loam, 3 to 8 percent slopes, moderately eroded, has moderate internal drainage and runoff. The hazard of erosion is severe in some seasons of the year. Plant nutrients are leached slowly from this soil.

Diversion terraces and closed drains are needed to prevent erosion and to remove excess water. Winter cover crops are needed to protect the soil from erosion and to improve the tilth. Most crops grown in the county, except the deep-rooted ones, will produce high yields if given proper amounts of lime and fertilizer. (Capability unit IIe–4; woodland suitability group 3.)

Watson silt loam, 8 to 15 percent slopes, moderately eroded (WsC2).—The profile of this soil is similar to the one described as typical for the Watson series. It differs in that the solum is 30 to 36 inches thick. Also, in most places, this profile lacks the B_{24g} horizon, the other horizons are thinner, and there are 10 to 20 percent more coarse fragments throughout.

Runoff from this soil is moderately rapid. Internal drainage and leaching of plant nutrients are moderate.

Erosion is the most serious problem on this soil. Diversion terraces, stripcropping, and long cropping systems that include hay and winter cover crops seeded in corn are needed. Lime and fertilizer, applied according to the needs indicated by soil tests, are required to obtain highest yields. (Capability unit IIIe–5; woodland suitability group 3.)

Watson silty clay loam, 8 to 15 percent slopes, severely eroded (WtC3).—The profile of this soil is similar to the one described as typical for the Watson series. This soil differs in that the solum is 26 to 32 inches thick, the surface layer is reddish brown speckled with yellowish red, and one or more of the B subhorizons is lacking.

Internal drainage and leaching of plant nutrients are moderate in this soil. Runoff is moderately rapid, and 8 to 12 inches of the original soil has been lost through erosion. The soil is best suited to permanent hay.

Diversion terraces are needed to protect new seedings while they are becoming established. For best stands and yields, lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit IVe–4; woodland suitability group 3.)

Wurtsboro Series

The Wurtsboro series consists of soils in which the upper part of the solum is yellowish brown to dark brown. At a depth of 24 to 30 inches is a mottled brown and pinkish-gray layer, which overlies a dark-brown to reddish-brown fragipan. The soils are moderately well drained and are medium textured to coarse textured. Most of them are stony.

These soils have formed in glacial till from the last period of glaciation. The till was derived from grayish sandstone, shale, siltstone, and conglomerate. Some of the till is reddish. In Kidder Township the Wurtsboro soils occur on slightly dished lower slopes; on flat, slightly pitted areas; and on smooth, gentle slopes. They are underlain by massive bedrock or by compact till at a depth of 3 feet or more.

The native vegetation on these soils was mainly hard maple and beech. The present woodlands consist mainly of red maple, white oak, laurel, and aspen.

Wurtsboro soils have formed in parent material like that of the adjacent Lordstown, Swartswood, Volusia, Lickdale, and Tughill soils. They are deeper than the shallow, well-drained Lordstown soils but are less well drained than the deep, well-drained Swartswood soils. The Wurtsboro soils are better drained than the somewhat poorly drained to poorly drained Volusia and the very poorly drained Lickdale and Tughill soils. They are similar to the Drifton soils, which are south of the Wisconsin glacial boundary but are coarser textured and have a more strongly expressed pan.

Typical profile (undisturbed Wurtsboro very stony loam on a slope of 4 percent, in a wooded area):

A_1 0 to ½ inch, very dark gray (10YR 3/1) very stony loam containing much organic matter; 25 percent of mass is made up of pebbles and of stones up to 14 inches in diameter; weak, fine, granular structure; very friable; very strongly acid (pH 4.6); abrupt, broken lower boundary; layer ranges from 0 to 1 inch in thickness within a distance of a few feet.

A_2 ½ to 2 inches, dark-gray (10YR 4/1) very stony sandy loam; when dry, gray (10YR 6/1); 25 percent of mass is made up of pebbles and of stones up to 14 inches in diameter; single grain; very friable; very strongly acid (pH 4.6); abrupt, irregular lower boundary; layer ranges from 1 to 4 inches in thickness within a distance of a few feet.

B_{11r} 2 to 2½ inches, very dark brown (10YR 2/2) loam; 25 percent of mass is made up of pebbles and of stones up to 14 inches in diameter; weak, fine, subangular blocky structure; very friable; very strongly acid (pH 4.6); clear, broken lower boundary; layer ranges from 0 to 1½ inches in thickness within a distance of a few feet.

A'_2 2½ to 10 inches, yellowish-brown (10YR 5/6) loam; 25 percent of mass is made up of pebbles and of stones up to 12 inches in diameter; weak, fine, subangular blocky structure; friable; very strongly acid (pH 4.6); clear, wavy lower boundary; layer ranges from 6 to 8 inches in thickness within a distance of a few feet.

B'_1 10 to 14 inches, yellowish-brown (10YR 5/8) loam; 25 percent of mass is made up of pebbles and of stones up to 10 inches in diameter; moderate, medium, subangular blocky structure; friable; very strongly acid (pH 4.6); gradual, wavy lower boundary; layer ranges from 2 to 6 inches in thickness within a distance of a few feet.

B'_{22} 14 to 29 inches, strong-brown (7.5YR 5/6), heavy loam; 25 percent of mass is made up of pebbles and of stones up to 8 inches in diameter; moderate, medium, blocky and subangular blocky structure; thin, discontinuous clay films on peds; friable to firm; very strongly acid (pH 4.8); clear, wavy lower boundary; layer ranges from 13 to 17 inches in thickness within a distance of a few feet.

B'_{23g} 29 to 31 inches, dark-brown (7.5YR 4/4) fine sandy loam; many, medium, distinct mottles of brown (7.5YR 5/4), and pinkish gray (7.5YR 6/2); 25 percent of mass is made up of pebbles and of stones up to 8 inches in diameter; moderate, medium, platy structure; very firm; very strongly acid (pH 4.8); abrupt, wavy lower boundary; layer ranges from 2 to 3 inches in thickness within a distance of a few feet.

B'_{24g} 31 to 49 inches, dark-brown (7.5YR 4/4) and reddish-brown (5YR 4/4) loam with faint mottling; large polygons, 8 to 16 inches in diameter, separated by vertical bands, ¼ inch to 1 inch thick, consisting of yellowish-brown (10YR 5/6) very fine sandy loam bordered with strong brown (7.5YR 5/8); 25 percent of mass is coarse fragments up to 8 inches in diameter; weak, thick, platy structure breaking to weak, medium, subangular blocky; thick, discontinuous films of clay on peds; very hard; very strongly acid (pH 4.8); diffuse, wavy lower boundary; layer ranges from 13 to 23 inches in thickness within a distance of a few feet.

C_1 49 inches +, stony sandy loam to stony loam; friable.

The surface layer ranges from extremely stony loam to channery silt loam in texture. The texture in the subsoil is sandy clay loam, loam, or light clay loam. The color of the subsoil and substratum ranges from hues of 10YR to 5YR in places. Depth to the till is commonly 3 to 15 feet. The hardpan in the Wurtsboro soils is generally strongly expressed, but in places, it is only moderately strong. The concentration of clay in the B horizon ranges from less than 5 percent to a little more than 5 percent higher than that in the A horizon.

The Wurtsboro soils are slowly permeable and have moderately low moisture-holding capacity. Internal drainage is medium to slow, and leaching of plant nutrients is moderately slow. These soils are naturally very strongly acid.

Wurtsboro channery loam, 0 to 3 percent slopes (WuA).—In places this soil has lost about half the original surface layer through erosion. Most of the acreage, however, is uneroded or only slightly eroded. The plow layer is dark grayish brown, and the stones have been removed so that it can be cultivated. Except for these characteristics, the profile of this soil is similar to the one described as typical for the Wurtsboro series. Included are small areas in which the texture of the surface layer is channery loam or loam. Also included are a few small spots of somewhat poorly drained Volusia soil, too small to map separately.

A small acreage of Wurtsboro channery loam, 0 to 3 percent slopes, in Kidder Township has been cleared of stones and is fairly good for spring grains, hay, and pasture.

Because the terrain is nearly level, water accumulates and the soil remains wet for a time after rains. Terraces and closed drains are needed to remove excess water and to control erosion. Cover crops ought to be grown to prevent erosion, provide organic matter, and improve soil tilth. Lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit IIw–2; woodland suitability group 3.)

Wurtsboro channery loam, 3 to 8 percent slopes, moderately eroded (WuB2).—This soil has lost about half the original surface layer through erosion. The present surface layer is dark grayish brown and is about 6 inches thick. Except for these characteristics, the profile is like the one described as typical for the Wurtsboro series. Included are small areas in which the texture of the surface layer is channery silt loam.

In Kidder Township small areas of Wurtsboro channery loam, 3 to 8 percent slopes, moderately eroded, have been cleared of stones and are used for farming. Most of the acreage is now idle.

Diversions and covered drains are needed to control runoff and seepage. Cover crops and terraces are needed to improve soil tilth and control erosion. This soil is fairly good for spring grains and pasture. Lime and fertilizer should be applied according to the needs indicated by soil tests. (Capability unit IIe–4; woodland suitability group 3.)

Wurtsboro very stony loam, 0 to 8 percent slopes (WvB).—The profile of this soil is like the one described as typical for the Wurtsboro series. Included are areas of extremely stony Wurtsboro soils and small spotty areas of Volusia soils. In forested areas of this soil that have been burned over, the A_1 layer contains some charcoal.

Wurtsboro very stony loam, 0 to 8 percent slopes, is too stony for cultivation, but it is suited to pasture or trees. It should be managed for forestry and wildlife, and the vegetation, for protection of the watershed. Because of the pan and the moderate moisture-holding capacity, maple and coniferous trees are better suited to the soil than oaks. (Capability unit VIs–3; woodland suitability group 3.)

Wurtsboro very stony loam, 8 to 25 percent slopes (WvD).—The profile of this soil is somewhat shallower than the typical profile described because this soil has stronger slopes. Other features, however, are similar. Included are some extremely stony areas. In forested areas of this soil that have been burned over, the thin surface layer contains black streaks of charcoal.

More of the plant nutrients have been leached from this soil than from Wurtsboro very stony loam, 0 to 8 percent slopes. Runoff is also moderately rapid on this soil. The soil is too stony for cultivation, but it is suited to pasture and trees. The vegetation is suited to watershed protection. Moderately deep rooted trees grow fairly well if protected from fire and from the competition of other plants. (Capability unit VIs–3; woodland suitability group 3.)

Formation and Classification of the Soils

This section discusses the factors of soil formation and the classification of Carbon County soils by great soil groups.

Factors of Soil Formation

Soil is formed by weathering and other processes that act on parent material. The characteristics of the soil at any given place depend upon the climate, the physical and mineralogical composition of the parent material, the relief or lay of the land, the plant and animal life, and time. Through their effect on plants, climate and relief modify the characteristics of the soil. Relief, in turn, strongly influences drainage, aeration, runoff, erosion, and exposure to sun and wind.

Climate

Carbon County has a modified mountain type of climate. The valleys and mountains exert a great influence on the range of temperatures, air movements, and rainfall (*24*). A summary of temperature and precipitation typical for this area is shown in table 7.

Highly acid, infertile soils have generally formed in Carbon County under the influence of high rainfall and

TABLE 7.—*Temperature and precipitation at two stations*

[Jim Thorpe, Carbon County, elevation, 830 feet]

Month	Temperature [1]			Precipitation [1]			
	Average	Absolute maximum	Absolute minimum	Average	Driest year (1930)	Wettest year (1952)	Average snowfall
	°F.	°F.	°F.	Inches	Inches	Inches	Inches
December	30.4	67	−13	3.80	2.71	6.12	7.4
January	27.8	74	−20	3.61	1.74	4.76	10.9
February	27.9	75	−16	3.42	2.36	2.09	10.6
Winter	28.7	75	−20	10.83	6.81	12.97	28.9
March	37.3	88	−8	4.21	3.32	6.48	6.9
April	48.4	93	8	3.84	3.41	9.46	1.3
May	59.6	95	25	4.34	5.35	8.16	(3)
Spring	48.4	95	−8	12.39	12.08	24.10	8.2
June	67.7	100	32	4.39	2.83	2.16	(3)
July	71.9	104	39	5.35	1.94	8.82	0
August	69.7	103	36	4.77	2.12	6.93	(3)
Summer	69.7	104	32	14.51	6.89	17.91	(3)
September	63.7	103	24	4.02	4.36	6.00	(3)
October	52.2	93	15	3.79	.45	1.15	.1
November	41.2	82	1	3.71	2.88	9.46	2.3
Fall	52.3	103	1	11.52	7.69	16.61	2.4
Year	49.7	104	−20	49.25	33.47	71.59	39.5

[Mount Pocono, Monroe County, elevation, 1,915 feet]

Month	Temperature [2]			Precipitation [2]			
	Average	Absolute maximum	Absolute minimum	Average	Driest year (1931)	Wettest year (1952)	Average snowfall
	°F.	°F.	°F.	Inches	Inches	Inches	Inches
December	25.7	66	−22	3.56	1.47	8.81	9.8
January	23.3	69	−35	3.37	2.08	5.36	12.9
February	21.8	70	−25	2.94	1.65	2.34	12.1
Winter	23.6	70	−35	9.87	5.20	16.51	34.8
March	32.0	81	−18	3.95	3.84	7.15	10.4
April	42.4	88	0	3.89	1.88	11.50	3.1
May	54.0	94	19	4.35	5.04	5.69	(3)
Spring	42.8	94	−18	12.19	10.76	24.34	13.5
June	61.8	92	25	5.08	4.25	3.55	(3)
July	66.0	103	34	5.26	6.47	11.70	(3)
August	64.2	95	32	4.44	5.33	6.82	0
Summer	64.0	103	25	14.78	16.05	22.07	(3)
September	58.4	88	24	4.79	1.82	6.64	(3)
October	48.7	89	12	4.51	.80	.99	.3
November	36.5	77	−2	3.35	1.59	11.09	4.6
Fall	47.9	89	−2	12.65	4.21	18.72	4.9
Year	44.6	103	−35	49.49	36.22	81.64	53.2

[1] Jim Thorpe: Average temperature is based on a 63-year record, through 1955; highest temperature, on a 57-year record and lowest temperature, on a 59-year record, through 1952. Average precipitation is based on a 63-year record, through 1955; wettest and driest years are based on a 56-year record, in the period 1890–1955; snowfall is based on a 58-year record, through 1952.

[2] Mount Pocono: Average temperature is based on a 50-year record, through 1955; highest and lowest temperatures, on a 44-year record, through 1952. Average precipitation is based on a 50-year record, through 1955; wettest and driest years are based on a 37-year record, in the period 1902–1955; snowfall is based on a 41-year record, through 1952.

[3] Trace.

cool temperatures. The rainfall contributes to the breaking down of organic matter and the leaching of bases from the soils. Moisture and seasonal changes in temperature contribute to the breakdown of rocks and soil material.

In the interglacial past, soils of the Allenwood and Watson series developed with reddish-yellow colors and clayey subsoils in a climate that was probably warm and humid. More recently, extreme weather conditions of the Wisconsin glacial period influenced the development of the Montevallo, Klinesville, and Leck Kill soils. It affected other shallow to moderately deep soils to a lesser degree (*5*, *6*).

Precipitation is plentiful in the county, and most of the time it is well distributed throughout the year. However, dry periods late in summer and in fall are not uncommon over most of the county. United States Weather Bureau records at Jim Thorpe, and at Mount Pocono (in Monroe County) 14 miles northeast of Carbon County, show that the average annual precipitation is about 50 inches. Records at Jim Thorpe show that precipitation has ranged from 33.47 inches in 1930 to 71.59 inches in 1952.

There is a wide geographic distribution and a wide fluctuation of precipitation in any year. The mountain ridges are high enough to deflect storms and to cause rain to fall heavily in one place and very lightly a short distance away. Summer showers and thunderstorms are often shunted up the valleys.

Much of the rain in summer comes as intense thundershowers of short duration (*31*). As much as 0.4 inch of rain in a 5-minute period can be expected to fall once every 2 years. A fall of 0.6 inch in 10 minutes may occur once every 2 years. An inch of rain in 10 minutes can be expected once in 25 years.

Most heavy rains come in summer when the soil is under cultivation and plants need water. They occasionally occur in spring when the surface of the ground has thawed, but is frozen underneath. Sometimes they occur in fall when crops have been harvested and the ground is bare. When rain occurs under these conditions, runoff and soil losses may be high.

Over most of the county, about one-tenth of the precipitation falls as snow. Table 7 shows that the average annual snowfall is 39.5 inches at Jim Thorpe and 53.2 inches at Mount Pocono. In addition to adding moisture, snow protects the soil from freezing and thawing and prevents the subsequent breakdown of soil structure. It also protects wheat, legumes, and other living plants; pro-

tects earthworms, nitrifying bacteria, and other beneficial soil organisms; and reduces winter heaving. On north-facing slopes and in wooded areas, snow lasts longer than in other areas, melts more slowly, and decreases the danger of runoff.

The growing season is 160 days in the southern part of the county, according to records at the weather station at Jim Thorpe. The average date of the last frost in spring is generally about May 1, and the average date of the earliest in fall is about October 8. Frosts have occurred as late as May 29 and as early as September 8.

In the mountains, according to records at the weather station at Mount Pocono, the growing season is 126 days. The last frost in spring generally occurs about May 20, and the first in fall, about September 23. Frosts have occurred as late as June 17 and as early as September 4.

The average temperature during the growing season at Jim Thorpe is about 65° F. On Mount Pocono the average temperature is probably slightly lower than for most of the mountainous areas in Carbon County because of the generally higher elevation. This slight difference could account for the shorter growing season in that area and for more frost damage. In the mountains sustained cold spells sometimes freeze bare ground to a depth of 40 inches or more. Sod and trees, however, prevent the ground from freezing to so great a depth. Soils covered by a forest floor seldom freeze. The lower average temperature in the mountains and in the Quakake Valley generally favors the accumulation of more organic matter than in the lower part of the county, according to soil test information furnished by the county agent at Jim Thorpe.

Frost pockets and frost damage are a hazard in most of the valleys and in the mountains. Little fruit is grown now that could be damaged by frost late in spring. In the Quakake Valley and in the mountains along low-lying streams, corn is likely to be damaged by frost early in fall.

The winds are from west to north at different seasons of the year and at separate elevations. The prevailing winds are generally from the west, but at the higher elevations, they change so that they blow from a northerly direction in winter. Occasional tornadolike winds hit the county at odd areas in the valleys.

Parent material

GEOLOGIC HISTORY

In Paleozoic time Carbon County was eroded nearly level and was flooded by a shallow sea, which is now the Atlantic Ocean (*2, 7*). Mud and sand flowed into this shallow sea from land to the southeast. As the sediment became thicker, its weight caused the underlying rock to sink. The process continued for about 400 million years until the sediment was about 5 miles thick.

Areas that had been under water a long time were slowly raised high above sea level. Tremendous pressure from the southeast caused the flat layers of mud and sand to bend in long folds, much like a pile of rugs pushed horizontally. Tremendous anticlines, or crests, and synclines, or troughs, which run in a northeasterly direction, were formed. On Stony Ridge in the southern part of the county, and in other places, the pressure was so great that older rocks were pushed over younger ones. The heat and pressure involved in the severe folding and faulting, caused the escape of most of the gases from the coalbeds and resulted in the formation of hard coal, or anthracite.

Not all of Carbon County was folded uniformly. The true Valley and Ridge province, with folds ranging from 30 degrees to near vertical, contrasts with the area north of Mud Run and Pohopoco Mountain, which has folds of 1 to 6 degrees.[4]

Long, parallel valleys, underlain by weak shale and siltstone, were formed adjacent to ridges of stronger rocks. Low ridges between valleys have larger amounts of thinly bedded siltstone and some fine sandstone. Blue Mountain, Bear Mountain, and other major ridges were formed on steeply tilted, hard sandstone and conglomerate.

BEDROCK

Fourteen separate geologic formations make up the bedrock in Carbon County (*2, 13, 30*). These formations are all sedimentary and range in age from the post-Pottsville coal measures (Pennsylvanian) to the Tuscarora rocks (Silurian). Of these, the rocks of Pennsylvanian age are the youngest, and those of Silurian age, the oldest. The rich coal measures and the thick Catskill formations far exceed, in extent and economic importance, the thin and insignificant Onondaga and Helderberg formations in Carbon County.

The names of the formations along the Lehigh River follow. Their thickness and composition are also described.

Post-Pottsville formations: These formations consist of the youngest rocks in the Pennsylvanian series that are not exposed along the Lehigh River. The rocks are contained in two synclinal troughs. The maximum thickness of this formation that is exposed in Carbon County is about 975 feet. There are a number of coalbeds, mainly between sandstone and conglomerate.

Pottsville formation: This formation has a synclinal fold beneath the surface and forms a protective ring around the post-Pottsville formations. It belongs to the Pennsylvanian series. This formation is about 1,000 feet thick and consists mainly of coarse conglomerate and hard sandstone.

Mauch Chunk formation: This formation underlies the Pottsville formation and forms the Bloomingdale, Nesquehoning, Quakake, and Weatherly Valleys. It belongs to the Mississippian series, is about 2,160 feet thick, and consists chiefly of red, lumpy shale, sandstone, and siltstone. This formation is best exposed in the borough of Jim Thorpe.

Pocono formation: This formation, known as the ridge-maker, rims the entire area of coalfields. It is 750 to 1,250 feet thick and is of mainly hard, gray sandstone with some conglomerate and shale. It belongs to the Mississippian series and makes up most of Broad Mountain and the area along the Lehigh River in Penn Forest and Kidder Townships.

Catskill formation: This formation belongs to the Devonian series. It is 6,100 to 7,100 feet thick and consists of red, green, and gray siltstone, sandstone, and shale with a few conglomerate rocks. This formation lies below and next to the Pocono formation. Outcrops of the formation are along the Lehigh River from Jamestown to Flagstaff Mountain and to the Pocono Plateau in Kidder

[4] According to a personal communication from Mr. Harry Klemic, U.S. Geological Survey.

Township. The Catskill formation is the oldest one on the Wire Ridge syncline.

Portage formation: This formation crops out above Lehighton along a narrow belt about one-third of a mile wide. It forms a double outcrop around the Wire Ridge syncline south of Lehighton. The rocks are chiefly dark shale with thick beds of sandstone near the middle and the base. This formation is a member of the Devonian series.

Hamilton formation: This formation belongs to the Devonian series, and it underlies the Portage formation. It is about 1,400 feet thick and consists of dark shale, siltstone, and sandstone. This formation occurs in the Lehighton anticline and in a narrow belt above Bowmanstown.

Marcellus formation: This formation dips steeply to the north at Bowmanstown, and it consists of approximately 800 feet of black shale and some slate of the Devonian age.

Onondaga formation: The Onondaga formation is about 50 feet thick. It is about 5 feet of cherty limestone over hard, fine-grained, hydraulic limestone of varying thickness. Under this is a thin bed of clay underlain by a thicker bed of paint ore. The paint ore overlies a bed of clay that is next to the Oriskany sandstone.

Oriskany formation: This formation crops out on Stony Ridge. The beds are 268 to 400 feet thick and consist of granular sandstone of the Devonian series.

Helderberg formation: This formation consists of calcareous shale, cherty limestone, and impure limestone ranging from 55 to 207 feet in thickness. The rocks of this formation belong to the Devonian age. They underlie the Oriskany formation and are not conspicuously exposed.

Cayuga formation: This formation is buried under several feet of glacial and colluvial material and is along the broad valleys of Aquashicola and Lizard Creeks north of Blue Mountain. It consists of Silurian age red shale, thin-bedded, calcareous shale, and thin-bedded limestone. This formation is about 2,000 feet thick.

Clinton formation: This group belongs to the Silurian series and lies next to the Tuscarora formation. It consists of hard red, green, and white sandstone and conglomerate and of red and olive-green shale.

Tuscarora formation: This formation consists of the oldest rocks in the county. The rocks form high Blue Mountain, which is the southern boundary of the county. They consist mainly of hard sandstone and conglomerate rocks. The formation is about 457 feet thick at the point of maximum exposure. It dips steeply to the north.

Nearly all soil material in Carbon County is related to the local underlying bedrock, although glacial action has altered the rock. Exceptions are the parent materials of the oldest soils, which have been so deeply weathered that identification of the bedrock is difficult. Other exceptions are the soils formed in alluvium and soils on terraces, the parent materials of which probably were carried some distance from areas of similar rocks. It is presumed that most of the material deposited by the separate glaciers was carried only a short distance and is of local origin, as indicated by the glacial till of the last ice sheet (*6*).

Except for the fine-textured soils formed in alluvium, most of the soils in the county are medium textured. The soils range from sandy loam to loam or silt loam in texture, and most profiles contain coarse fragments—gravel, channers, or stones. In the valleys and on the low ridges, the texture is generally channery silt loam or gravelly silt loam, whereas loam and stony loam are common on the steep slopes and at the higher elevations. This indicates the relative weakness or hardness of the parent bedrock formations.

Nearly all of the formations consist of several strata of rock that vary in texture, color, and consistence. However, each formation is loosely identified by certain characteristics.

The Fleetwood soils and other soils in the same catena have formed from sandy glacial till derived mainly from the Pottsville and Oriskany formations. The soils in the Hazleton catena have formed in gray glacial till derived from the Pocono and Catskill formations. Soils of the Swartswood catena have formed in glacial till, derived from the same formations, but in a later geologic period.

Glacial till, derived mainly from reddish rocks of the Mauch Chunk and Catskill formations, underlies soils in the Meckesville and part of the Allenwood catenas.

Soils of the Hartleton catena have formed in material derived from the Portage, Hamilton, and Marcellus formations. The Allenwood catena of soils, because it is in a similar topographic position, is thought to have formed in bedrock material produced by an earlier glaciation and also in parent material from adjoining geologic formations.

Colluvial soils of the Laidig and Buchanan series have formed in a mixture of parent material derived from several formations, dominantly sandstone and quartzite. The constituents of this material vary slightly in different areas in which the Laidig and Buchanan soils occur.

Other geologic formations that were sources of soil material are of minor importance.

GLACIATED MATERIAL OF PRE-WISCONSIN AGE

All of Carbon County has been glaciated (*2*). The first, or Jerseyan, glacier advanced the farthest. It covered all of Carbon County and extended into southeastern Pennsylvania and New Jersey. The second, or Illinoian, glacier occurred about 200,000 to 300,000 years ago. One edge of it extended roughly to the Lehigh River, but tongues or lobes extended into the valleys toward the west. The Wisconsin ice sheet came as far as Lake Mountain and Hickory Run. It disappeared from this front about 15,000 to 20,000 years ago. Minor advances occurred in other areas, as evidenced by strings of potholes.

In the Mahoning Valley, remnants of the Jerseyan glacial period occur as deeply weathered, yellowish-red, clayey till. This material is in small areas, because most of it has been lost through erosion (*12*). Areas of similar till are within the boundary of Illinoian glaciation, mostly in Franklin and Towamensing Townships. This till was derived from grayish sandstone, siltstone, shale, and conglomerate rocks. The climate between glacial stages is believed to have been warmer than that during glaciations. It may have been similar to the climate that now prevails in the southeastern part of the United States. This warmer climate weathered the till and changed the colors drastically to what they are today (*5*, *6*).

Differences between the till of the two periods are minor. The Jerseyan till has a higher proportion of gravel, has smoother topography, is weathered more deeply, and has a more intense reddish color. The thickness of the Jerseyan till is commonly more than 6 feet; in places

it is more than 150 feet. Vast areas are not covered by till.

Other areas of pre-Wisconsin glaciation have till of variable thickness. Many areas in the mountains consist of rock outcrops or are covered by stones and boulders and contain little soil material. In these areas the till ranges in thickness from a thin mantle to a layer 25 to 30 feet thick in the Meckesville area. The till is commonly around 12 feet thick in the mountains and in Wild Creek Valley. In contrast, it is 3 to 8 feet thick in the southern part of the county.

GLACIATED MATERIAL OF WISCONSIN AGE

The latest ice sheet invaded Carbon County 15,000 to 20,000 years ago. Geologists call this the Wisconsin glacier. This glacier advanced as far south as the Lake Mountain and Hickory Run areas, where a warmer climate halted its advance. It melted slowly, leaving slightly rounded rocks and boulders, deep till, boulder fields, and swamps as evidence.

The till reflects the characteristics of the local bedrock, which consists of red and gray sandstone, siltstone, shale, and conglomerate rocks. Along the margin, the ice sheet left a pitted outwash plain consisting of deep, irregularly stratified sand, silt, and gravel and swamps and potholes (*14*). On the crests of the folded ridges and along the Lehigh River, a thin mantle of soil material was deposited. In places the bedrock was scoured clean.

The parent material of the soils is mainly local in origin. Numerous slightly rounded stones and boulders cover most of Kidder Township today. Only a very small part of the glaciated area has been cleared for farming.

As the ice melted from the glaciers, the valleys became filled with gravel, sand, and silt, and a mantle of till remained on the valley walls and ridgetops (*8*). Much of the valley fill was laid down by running water as stratified material. Later, the streams cut new channels into these deposits, leaving broad terraces similar to those along Aquashicola Creek. Along most other streams in the county are narrow bands of alluvial material washed from the glacial front.

PERIGLACIAL ACTIVITY SOUTH OF THE WISCONSIN TERMINAL MORAINE

It is reasonable to assume that glaciers deposited more soil material than is now present in the area south of the Wisconsin terminal moraine. Recent studies help explain the natural processes that took place in a wide area adjacent to the Wisconsin front (*5*, *6*). Periglacial frost action, similar to that taking place in Arctic regions today, removed much of the soil mantle and till. The severe climate associated with glaciers—wind, rain, and alternate freezing and thawing—radically altered the surface of the ground. Many shallow soils in Carbon County today were formed in the wake of this change. Areas of these shallow soils are on the shale ridges in the southern part of the county and in the vicinities of Weatherly and Quakake.

The apparent channery condition of the surface layer is but one visible effect of glacial frost action. Other evidences of glacial frost action are the disintegration of bedrock to a depth of several feet, the churning of the rock fragments into whorls, and the leaching of thin layers of finer textured soil. Boulder stripes and boulder rings are common on the surface in the stony area adjacent to the Wisconsin front. Along the base of Blue Mountain are cryoplane terraces 5 to 15 feet high, 25 to 50 feet wide, and several hundred feet long (*19*). These are roughly parallel with, and diagonal to, the slope.

On the moderate slopes in Penn Forest and Kidder Township, south of the Wisconsin front, 2 to 3 feet of reworked, medium-textured till covers many acres of underlying clayey loam material.

Frost action affected the soil material south of the last glacial front (*5*, *6*). As a result of the severe climate, avalanches, landslides, and mudflows were common for miles south of the front. Undoubtedly, much of the colluvial material resulting from severe frost action collected at the bases of steep mountains. Many shallow soils are residual. Those on some of the steep slopes probably are the remains of eroded soils.

Relief

The relief in Carbon County ranges from level or depressed to very steep. The highest point in the county is Lake Mountain, which has an elevation of 2,240 feet. The lowest, about 393 feet above sea level, is the place where the Lehigh River flows out of the county. Nearly all the county is drained by the Lehigh River, which is a tributary of the Delaware River. Small areas are drained by the Schuylkill and Susquehanna Rivers.

Relief has a profound influence on the formation of soils. On steep slopes soil loss generally keeps pace with soil formation; the soils are generally thin and show little horizonation. Soil material accumulates along the bases of steep slopes. A greater amount accumulates along the bases of moderate slopes than along the bases of steeper slopes. Drainage is generally better on the steeper slopes. Organic matter, minerals, and bases are leached more readily from soils that are well drained.

Vegetation

Carbon County was once entirely under forest. Large areas in the northern part of the county were covered by hard maple, birch, and beech. In the mountainous part, they were covered by white pine and hemlock and, in the southern part, by white pine and red and white oaks. In smaller areas white pine and hemlock grew on steep, north-facing slopes and along streams. Chestnut, chestnut oak, aspen, gray birch, pin cherry, white pine, and black oak grew on dry, stony, and shallow soils. Tall spruce grew in the northern swamps, and hickory and ash grew along streams in the southern part of the county.

The vegetation in an area east of Meckesville was an outstanding exception. Here, in the burned areas, grew dense stands of scrub oak, gray birch, pitch pine, and huckleberry. This and other areas were burned over periodically to encourage the growth of huckleberries. As a result of this practice, the organic matter was consumed, and eventually only scrub oak, huckleberry, and pitch pine could survive on the burned-over areas. As fires were eliminated, the organic matter was built up, enabling white oak, white pine, and other good species to establish themselves through natural seeding.

Hard maple is only rarely a component in the present woodlands. Beech and yellow birch grow along creeks on moist sites, on north-facing slopes, and on the less well drained soils. Red maple and oak are dominant in many older stands on deep soils. In two or three areas in the mountains, white pine and hemlock grow on moist

TABLE 8.—*Soil series arranged into catenas according to topographic position, parent material, and natural drainage*

Topographic position and parent material	Well-drained soils			Moderately well drained soils	Somewhat poorly drained soils	Poorly drained soils	Very poorly drained soils
	Shallow	Moderately deep	Deep				
Uplands:							
Glaciated material of pre-Wisconsin age—							
Compact till from red and olive shale and siltstone.	Klinesville	Leck Kill	Allenwood	Watson	Alvira	Shelmadine	Norwich.
Till from red sandstone, siltstone, and shale.	----------	----------	Meckesville	Albrights	Alvira	Shelmadine	Norwich.
Strongly weathered, deep till from gray, acid sandstone and shale.	----------	----------	Allenwood	Watson	Alvira	Shelmadine	
Till from gray, acid sandstone, some shale, and conglomerate.	Dekalb	Dekalb	Hazleton	Drifton	Alvira	Shelmadine	Tughill.
Till, mainly from quartzite.	Fleetwood	----------	Fleetwood	Natalie	Natalie	Andover	
Till, mainly from thin-bedded, gray, acid shale, but containing some siltstone and sandstone.	Montevallo	Hartleton	Hartleton	Comly	Comly	Shelmadine	Lickdale.
Glaciated material of Wisconsin age—							
Till from red and gray, acid shale and sandstone.	Leck Kill	Leck Kill	Meckesville	Albrights	Morris	----------	Norwich.
Till from gray, acid sandstone and shale.	Lordstown	Lordstown	Swartswood	Wurtsboro	Volusia	----------	Tughill.
Colluvial slopes:							
Sandstone, quartzite, and some shale; some glacial influence.	----------	----------	Laidig	Buchanan	Buchanan	Andover	Andover.
Deep deposits of acid, gray fragments of shale.	----------	----------	Rushtown	----------	----------	----------	
Terraces:							
Glacial outwash or frost-worked material—							
Mainly from gray, acid sandstone and shale; gravel at a depth of 2 to 3 feet.	----------	----------	Conotton	----------	----------	----------	
Mainly from red, acid sandstone and shale.	----------	----------	Tunkhannock	----------	----------	----------	
Medium- to fine-textured terrace deposits (pre-Wisconsin age).	----------	----------	----------	Pekin	Pekin	----------	
Flood plains:							
Acid alluvium from gray sandstone and shale; some red material included.	----------	----------	Tioga	Middlebury	----------	Holly	Papakating.

or less than well-drained sites. These two species grow in great quantity on steep, north-facing slopes protected from wind and sun, such as along Pohopoco Creek. In colluvial areas of the Laidig and Buchanan soils, mixed oaks, white pine, and red maple make fair growth. Rhododendron and mountain-laurel and sheep-laurel are frequently in the understory of many forested areas, particularly on moist and very stony areas.

Trees, shrubs, and other plants take nutrients from the soil through the roots. They add organic matter to the soil in the form of leaves, dead roots, and twigs.

Trees and other plants improve the porosity and aeration of the soil through the growth of roots and through their effect on the biological activity of the soil. Thus, vegetation has a profound effect on the development of the soils.

Clearing the forests and cultivating the soils have made significant changes in the soil profiles. Plowing has mixed the surface and subsurface horizons into a brown or black plowed layer. It further exposed the soils to sheet erosion, which has occurred on most sloping soils. Some eroded areas, particulary of shallow soils, are idle or have reverted to woodland. In time, these soils are gradually leached of humus and bases, and conditions similar to those that existed before cultivation are restored. Many of the Montevallo and Klinesville soils are wooded. The trees are mainly chestnut oak, chestnut sprouts, gray birch, and sassafras, but there is some white pine. Idle areas of

these soils are covered by sumac, pin cherry, povertygrass, and blackberry.

Cultivation, grazing, and the use of heavy machinery have caused the open and porous soils, in many places, to become compacted. Adding lime and fertilizer and growing sod and leguminous crops have tended to reduce the effects of compaction but have not completely eliminated them. Soils once low in fertility and strongly acid are now alkaline or only slightly acid in the upper three or four horizons.

Changes in use, in vegetation, and in artificial drainage change the soil profile gradually. Housing developments and strip mining change it radically.

Soil catenas

A catena is a group of soil series in which the constituent soils vary in characteristics that are related to differences in relief and drainage and, in some cases, to depth to bedrock. Table 8 shows the soil series in Carbon County arranged into catenas according to topographic position, parent material, and natural drainage.

Classification of Soils in Great Soil Groups

Soil series are classified in great soil groups for ease in remembering their major characteristics and studying their relationships. Soils in a great soil group have common internal characteristics. These characteristics have developed through the influence of broad geographic factors of vegetation and climate, or locally significant factors of parent material or relief, or a combination of geographic and local factors.

The soil series in Carbon County have been classified in the following great soil groups.

Great Soil Group:	*Soil series*
Red-Yellow Podzolic soils	Allenwood. Buchanan. Laidig. Watson.
Gray-Brown Podzolic soils	Conotton.
Gray-Brown Podzolic soils intergrading to Red-Yellow Podzolic soils.	Albrights. Comly. Drifton. Fleetwood. Hartleton. Hazleton. Meckesville. Natalie. Pekin.
Gray-Brown Podzolic soils intergrading to Low-Humic Gley soils.	Alvira.
Sols Bruns Acides	Dekalb. Leck Kill. Lordstown. Swartswood. Tunkhannock. Wurtsboro.
Sols Bruns Acides intergrading to Low-Humic Gley soils.	Morris. Volusia.
Low-Humic Gley soils	Andover. Holly. Shelmadine.
Humic Gley soils	Lickdale. Tughill. Norwich. Papakating.
Lithosols	Klinesville. Montevallo.
Regosols	Rushtown.
Alluvial soils	Middlebury. Tioga.

The descriptions of characteristics of soils in the great soil groups follow.

Red-Yellow Podzolic soils

The soils in this group have thin organic and organic-mineral horizons if they have not been cultivated. They have a light-colored, leached A_2 horizon and a red, yellow, or yellowish-red B horizon, which contains more clay than the A or C horizon. Leaching has removed most of the exchangeable bases from the solum. Weathering has produced clays that are mainly in the kaolinite group. The soils have a fairly low exchange capacity and a low shrink-swell potential.

Soils of the Allenwood, Buchanan, Laidig, and Watson series belong to the Red-Yellow Podzolic group. The Allenwood soils are well-drained members of the group. The Laidig soils have formed in colluvial material. They are well drained and have a moderate fragipan in the lower B and upper C horizons. The Buchanan and Watson soils are moderately well drained and have a definite fragipan.

Four profiles of the Allenwood series and two of soils in the Watson series have been sampled for series characterization. The data obtained in the characterization analyses are shown in table 9.

Gray-Brown Podzolic soils

The Gray-Brown Podzolic group consists of soils that have a thin humus layer (where undisturbed), a dark-colored surface layer containing some organic matter, a leached, grayish, mineral A_2 horizon, and a brown or grayish-brown subsoil containing more clay than the surface soil. Soils in this group have retained a moderate amount of exchangeable bases.

The Conotton is the only series in this great soil group. The soils in this series are well drained and are medium to coarse textured. They are on alluvial terraces. The Conotton soils have the color, texture, and horizonation typical of Gray-Brown Podzolic soils, although the solum is only moderately deep and base saturation is probably moderate. The B horizon has definitely more clay than the A horizon. The clay minerals are mainly of the illite type; they have a moderate base-exchange capacity and a moderate shrink-swell potential.

Gray-Brown Podzolic soils intergrading to Red-Yellow Podzolic soils

Many of the soils in Carbon County have characteristics of both the Gray-Brown Podzolic and Red-Yellow Podzolic groups. They have most of the characteristics of Gray-Brown Podzolic soils but are more leached and acid. Some of these soils have developed from material derived from red siltstone and shale and retain the colors of the parent material in the profile.

Soils of the Albrights, Comly, Drifton, Fleetwood, Hartleton, Hazleton, Meckesville, Natalie, and Pekin series are in this grouping. They have characteristics of both groups. These soils have the light, leached A_2 horizon, the textural B_1 horizon, and the structural development similar to that of the Gray-Brown Podzolic soils. However, they have the leached, acid condition and, to some extent, the colors and the type of clay in the B horizon similar to those of the Red-Yellow Podzolic soils.

The Albrights and Meckesville soils have reddish colors inherited from the parent material. The other soils have formed in material derived from grayish rocks, but they

have colors tending to yellow, brown, and red as a result of weathering processes.

All of these soils are leached, but the Fleetwood, Hartleton, Hazleton, and Meckesville have the deeply leached characteristics typical of Red-Yellow Podzolic soils. The Albrights, Comly, Drifton, Natalie, and Pekin soils have moderate to well-expressed fragipans, or firm horizons, which impede leaching as much as they impede drainage.

Two profiles each of the Drifton, the Hartleton, and the Hazleton soils have been sampled for series characterization. The data obtained in the analyses are shown in table 9.

Gray-Brown Podzolic soils intergrading to Low-Humic Gley soils

Soils of the Alvira series are in this grouping. They are somewhat poorly drained and are typical of this intergrade position. These soils have the accumulation of clay, the structure, and the sequence of horizons typical of the Gray-Brown Podzolic group. However, they also have the thin, black organic surface horizon and the dense, strongly mottled lower subsoil characteristic of the Low-Humic Gley group.

Sols Bruns Acides

The Sols Bruns Acides are acid but do not have the accumulated clay in the B horizon that is characteristic of the Gray-Brown Podzolic and the Red-Yellow Podzolic soils. They may show the result of some movement of clay by the presence of thin, discontinuous clay film in pores and on the peds, or soil structural aggregates. In this county many of the Sols Bruns Acides in a virgin condition have a podzolic profile developed in the surface 3 to 6 inches. This micropodzol profile consists of a strongly leached, gray horizon and a thin, dark-brown upper B horizon. These horizons, however, are so thin that they are destroyed by cultivation and sometimes by pasturing, or through biological changes.

In this group are the soils of the Dekalb, Leck Kill, Lordstown, Swartswood, Tunkhannock, and Wurtsboro series. Of these, the Dekalb, Leck Kill, and Lordstown soils are shallow to moderately deep over bedrock. The Wurtsboro soils are moderately well drained and have a strongly expressed fragipan; the Swartswood soils have a fragipan but are well drained. The Tunkhannock soils are deep and well drained.

The Leck Kill and Tunkhannock soils formed from reddish parent material. The Dekalb, Lordstown, Swartswood, and Wurtsboro soils formed in material derived from grayish rocks.

The Dekalb soils are representative of the Sols Bruns Acides. They have the uniform color, texture, and weak structural development characteristic of the Sols Bruns Acides. Two profiles of the Dekalb soils have been sampled for series characterization. The data obtained in the characterization analyses are shown in table 9.

Sols Bruns Acides intergrading to Low-Humic Gley soils

The horizons of these soils are similar in texture and structure throughout the profile. In these characteristics they are like the Sols Bruns Acides. In addition, they have the thin, black surface layer and strongly mottled subsoil typical of the Low-Humic Gley soils. These intergrades have developed in places where there is a fluctuating water table.

The soils of the Morris and the Volusia series, which are somewhat poorly to poorly drained, are Sols Bruns Acides that intergrade to Low-Humic Gley soils. They have uniform texture and color, weak structure, and horizonation typical of the Sols Bruns Acides group. However, they have the strong mottling and gleyed subsoil typical of the Low-Humic Gley group. They are strongly leached and acid.

The Volusia soils are representative of this group. They have formed from grayish parent material. In contrast, the Morris soils have formed in material weathered from red rocks.

Low-Humic Gley soils

The Low-Humic Gley soils are poorly drained and have a surface layer that is moderately high in organic matter. These soils have a black or very dark grayish-brown surface layer over mottled brown and gray or reddish horizons. The underlying horizons are not strongly differentiated as to texture. These soils have developed in an area where there is a fluctuating high water table.

The Andover, Holly, and Shelmadine soils are poorly drained to somewhat poorly drained and are in the Low-Humic Gley group. They have a firm horizon, or fragipan, at a shallow to moderate depth. This layer impedes the movement of water through the soil. In some places the water table is high. The Shelmadine very stony silt loam, described elsewhere in the report, is typical of the soils in the Low-Humic Gley group. It has the strong mottling, the gray matrix, and the thin humus layer characteristic of soils in the Low-Humic Gley great soil group.

Humic Gley soils

The soils in this group are poorly or very poorly drained. They consist of a very dark gray to black surface layer, 4 to 8 inches thick, over gray subsoil. Organic matter accumulates on the surface as a result of the soils being waterlogged much of the time.

Under wet conditions, microbiological activity is anaerobic, at least part of the time. Thus, conditions are created that favor the reducing process in which compounds of iron become soluble and may be removed in seepage. This process causes the Humic Gley soils to be gray or mottled.

The Lickdale, Tughill, Norwich, and Papakating soils are in this great soil group. They are very poorly drained and have a moderately thick, black surface layer that overlies a gray subsoil. The Lickdale, Tughill, and Norwich soils have formed from glacial till. Some profiles also contain local alluvium. The Papakating soils occur on flood-plain deposits along streams. They are more gleyed than is characteristic of soils of the Low-Humic Gley group because they are under water longer and, consequently, are less well aerated. The Norwich soils are representative of the soils in this group.

Lithosols

Lithosols are thin, slightly developed soils on rock, in this county sandstone, shale, or siltstone. The normal sequence of horizons is an A horizon over the parent C horizon of broken bedrock.

The Klinesville and Montevallo soils are shallow and are in this group. They have little soil development and

are only 6 to 18 inches thick over the broken, thin-bedded siltstone and shale bedrock. The Montevallo soils are representative of this group.

Two profiles each of the Klinesville and Montevallo soils were studied for series characterization. The data obtained in the characterization analyses are shown in table 9.

Regosols

Regosols are soils with a very low degree of profile development. They consist of deep, loose, unconsolidated material, such as sand, gravel, or shale chip.

The Rushtown are the only soils in this group. These soils have little profile development and have formed on uniformly fine shale chips derived from colluvial or alluvial material. The deposits are deep and unconsolidated. The Rushtown shaly silt loams, described elsewhere in the report, are representative of the Regosol great soil group.

Alluvial soils

The soils in this group have formed in recently deposited soil material, and they show little development of horizons. In most places they have a weakly expressed A horizon that overlies the parent material, or C horizon. The parent material is fine sediment that was deposited by streams during successive periods of flooding.

The Middlebury and Tioga soils on flood plains are members of this group. The soils of both series are medium textured and lack a well-developed profile.

The Tioga soils are dark brown and well drained; the Middlebury are moderately well drained and have duller colors. The Tioga soils are typical of the soils in this group.

Laboratory Data [5]

The Allenwood, Dekalb, Drifton, Hartleton, Hazleton, Klinesville, Montevallo, and Watson—the main soils in the county—were sampled in the field for detailed characterization analyses. Samples were obtained of soils on the most representative slopes, under the most typical erosion conditions, and in the dominant land use. Four-quart samples were collected at each location. The sampling and analytical methods used are discussed in the following paragraphs.

In all chemical procedures, air-dry samples were crushed with a rolling pin to pass through a 2 mm. round-hole sieve; care was taken to avoid fragmenting nonsoil material. Material retained by sieve is reported as "greater than 2 mm." All laboratory determinations except bulk density were performed on the fraction less than 2 mm. in diameter, and the results in table 9 are reported on that basis. Analysis for particle-size distribution was made by the pipette method, with dispersion in sodium hexametaphosphate and mechanical shaking using the method of Kilmer and Alexander (*10, 11*).

The pH was determined using the Beckman aeromatic pH meter and a 1 : 1 soil-water ratio. Organic carbon was determined by wet combustion using a modification of the Walkley-Black method (*17*). The Kjeldahl method (*3*), modified by trapping ammonia in a boric acid solution and titrating with sulphuric acid, was used to determine total nitrogen.

Exchangeable hydrogen, calcium, magnesium, and the cation-exchange capacity were determined by extraction with neutral normal ammonium acetate (*17*). The cation-exchange capacity was determined by summation of exchangeable cations and the distillation of absorbed ammonia after extraction with sodium chloride. Exchangeable sodium and potassium were determined with a model 52a Perkin-Elmer flame photometer. Bulk density, expressed in grams per cubic centimeter, was determined on 1- by 2-inch cylindrical core samples taken in a modified Uhland core sampler (*23, 26*).

Moisture retention at ⅓ atmosphere tension was determined on core samples on a porous plate (*26*). Moisture retention at 15 atmospheres tension was determined on fragmented samples in a pressure-membrane apparatus (*20*). Clay minerals were determined by means of a Norelco X-ray spectrometer equipped with a Geiger counter and chart recorder and using a copper target.

Flat, oriented clay samples, less than 2 microns, in the form of a thin film on a glass slide were analyzed as magnesium saturated-water solvated, as magnesium saturated-glycerol solvated, and as potassium saturated-water-solvated specimens. Prior to saturation the clays had the organic matter removed by treatment with 10 percent H_2O_2, and free iron oxides were removed by the method of Jeffries (*9*).

The soils analyzed generally were loams, silt loams, and silty clay loams. They contained an abundance of coarse fragments, ranging from chips of shale to boulders. The B horizon in the Allenwood, Drifton, and Watson soils had a distinct concentration of clay. Little migration of clay had occurred in the Dekalb, Hartleton, Hazleton, Klinesville, and Montevallo soils, except that some clay was evident in the coatings in pores and on ped surfaces.

Bulk density could not be determined for some of the soils because the samples contained pebbles and fragments of stone. Where this feature could be measured, a high density indicated the location of a compact or slowly permeable horizon.

Supplies of organic matter are relatively low in the soils that were sampled. The carbon-nitrogen ratio in most forested soils is relatively high in the surface layer and subsoil. It is reduced in soils that have been cultivated and that are in grasses and legumes or that have been fertilized. In such soils the ratio is very low in the lower subsoil and in the C horizon.

The cation-exchange capacity is relatively low and the degree of saturation of bases is low in the noncultivated soils. The upper horizons of cultivated soils show the effects of heavy liming in the buildup of calcium. This effect sometimes extends to a considerable depth.

Clay minerals are chiefly kaolinite, illite, chlorite-like material, and vermiculite. The horizons of a profile contain varying amounts of these clay minerals. Relative ratings of the horizons in one profile apply only to that profile and may not mean the same in another profile. The actual quantity of a mineral rated "abundant" in the horizon of one profile is not necessarily the same as the quantity given the same rating in another profile.

Some of the results of the characterization analyses of the various soils are described in the following paragraphs. The analytical data for each layer of soil in the various profiles sampled for characterization are given in table 9.

[5] Laboratory analyses were conducted by R. P. Matelski, C. F. Engle, and E. C. Mason, Pennsylvania Agricultural Experiment Station, Pennsylvania State University.

TABLE 9.—*Soil characterization data for*

[Dashes or blank spaces in columns indicate

Soil type, sample number, and location of sample site	Horizon	Depth from surface	Particle-size distribution							Coarse fragments (greater than 2 mm.)	Textural class	Bulk density	Moisture held at—		Organic matter
			Very coarse sand (2 to 1 mm.)	Coarse sand (1 to 0.5 mm.)	Medium sand (0.5 to 0.25 mm.)	Fine sand (0.25 to 0.10 mm.)	Very fine sand (0.10 to 0.05 mm.)	Silt (0.05 to 0.002 mm.)	Clay (less than 0.002 mm.)				Tension of ⅓ atmosphere	Tension of 15 atmospheres	
		Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*		*G. per CC.*	*Percent*	*Percent*	*Percent*
Allenwood gravelly loam and silt loam; S57Pa.13–2; along Route 13016, three-fourths of a mile south of U.S. Highway 209.	A_p	0–9	1.0	1.3	1.2	2.1	7.6	66.4	20.4	30.2	Silt loam	(2)	27.8	9.9	2.74
	B_1	9–15	1.5	1.3	1.1	1.6	6.4	63.3	24.8	26.2	Silt loam	(2)	26.2	11.0	.53
	B_{21}	15–22	.9	1.3	1.0	1.6	5.4	64.0	25.8	36.8	Silt loam	(2)	26.3	11.1	.25
	B_{22}	22–28	.5	.8	.8	1.3	4.2	60.6	31.8	39.6	Silt loam	(2)	28.8	12.8	.19
	B_{23}	28–36	1.4	1.5	1.3	1.6	3.2	45.5	45.5	40.9	Silty clay	(2)	31.6	16.0	.19
	B_3	36–41	3.3	3.7	2.5	2.5	3.4	25.8	58.8	29.6	Clay	(2)	31.8	22.0	.19
	C_1	41–52	4.2	3.9	2.8	2.8	3.8	24.4	58.4	47.0	Clay	(2)	33.8	24.2	.22
Allenwood gravelly loam and silt loam; S57Pa.13–7; 4.5 miles west of Lehighton along Route 443.	A_p	0–11	7.7	6.3	7.0	5.0	3.2	47.5	23.3	32.2	Loam	1.48	25.3	9.6	2.56
	B_1	11–14	8.0	6.9	6.5	5.1	3.2	47.8	22.5	37.5	Loam	1.56	24.1	9.6	1.75
	B_{21}	14–18	8.4	8.6	6.8	4.3	3.0	43.2	25.7	44.2	Loam	1.57	25.1	10.9	.92
	B_{22}	18–25	6.9	8.1	6.4	4.2	2.5	42.5	29.4	53.9	Clay loam	(2)	26.8	12.2	.67
	B_{23}	25–32	8.6	11.3	8.8	4.6	2.5	33.0	31.2	59.6	Clay loam	(2)	26.0	13.3	.55
	B_3	32–36	5.8	6.9	5.9	4.3	3.2	26.4	47.5	57.1	Clay	(2)	32.0	19.6	.39
	C_1	36–43	7.1	7.5	9.5	13.2	7.0	24.9	30.8	48.5	Clay loam	(2)	23.8	12.7	.19
Allenwood gravelly silt loam; S57Pa.13–10; 3⅘miles west of Hudsondale.	A_p	0–10	2.6	2.5	1.9	6.7	13.8	59.0	13.5	35.9	Silt loam	1.28	32.7	8.7	3.71
	B_1	10–15	3.8	3.5	2.1	5.6	11.8	52.7	20.5	37.3	Silt loam	1.66	27.8	8.9	.86
	B_{21}	15–22	4.5	3.9	2.6	6.3	11.6	52.3	18.8	31.6	Silt loam	1.64	24.8	9.0	.31
	B_{22}	22–31	3.0	3.3	2.6	6.1	12.6	53.3	19.1	22.5	Silt loam	1.64	27.3	9.2	.10
	B_3	31–39	2.6	3.4	2.4	5.5	10.9	51.4	23.8	26.2	Silt loam	1.64	26.6	9.9	.07
	C_1	39–44	6.0	6.7	3.7	3.9	7.9	51.1	20.7	57.0	Silt loam	------	------	11.7	.28
Allenwood gravelly silt loam; S57Pa.13–12; three-fourths of a mile east of Hudsondale.	A_p	0–9	1.4	1.7	1.8	6.8	15.3	52.7	20.3	19.6	Silt loam	1.43	31.6	------	2.68
	B_1	9–13	2.0	2.3	2.0	7.6	16.2	51.0	18.9	10.8	Silt loam	1.63	26.6	------	.51
	B_{21}	13–18	3.2	2.9	2.4	7.6	16.8	45.3	21.8	32.4	Loam	1.61	25.8	------	.36
	B_{22}	18–28	6.6	7.7	5.0	5.8	11.1	41.6	22.2	65.5	Loam	1.79	25.4	------	.17
	B_3	28–35	7.2	8.4	5.2	4.0	4.5	43.6	26.9	48.8	Loam	------	28.0	------	.10
	C_1	35–45	8.2	10.7	4.7	2.8	7.3	45.7	20.6	35.6	Loam	------	26.4	------	.07
	C_2	45–60	8.4	10.2	5.3	5.1	12.1	38.8	20.1	46.7	Loam	------	24.8	------	.09
Dekalb very stony loam; S57Pa.13–21; on north boundary of Jim Thorpe, along Route 903.	A_0	2–0	22.1	16.3	21.5	9.1	3.6	22.8	4.6	-------	Coarse sandy loam.	(2)	23.2	15.5	13.66
	A_1	0–4	3.3	11.3	17.8	14.0	5.1	35.9	12.6	25.0	Loam	(2)	24.0	6.7	3.69
	A_2	4–10	3.6	10.8	18.9	15.6	5.8	30.9	14.4	42.2	Sandy loam.	(2)	20.7	7.3	1.26
	A_3	10–16	3.8	13.2	20.0	16.1	5.2	31.4	10.3	50.4	Sandy loam.	(2)	16.8	3.5	.35
	B_3	16–25	5.7	14.0	20.5	14.4	5.2	28.6	11.6	38.1	Sandy loam.	(2)	16.0	5.4	.10
	C_1	25–38	5.1	11.4	17.2	12.9	4.9	28.4	20.1	34.5	Loam	(2)	18.7	7.1	.07
Dekalb very stony loam; S57Pa.13–22; along Route 13042, 1 mile south of Route 903.	A_0	2–0	6.5	3.1	15.0	15.6	7.4	38.4	14.0	-------	Loam	(2)	41.6	19.6	14.34
	A_1	0–2	1.8	3.6	15.4	17.4	6.8	41.1	13.9	50.3	Loam	(2)	32.2	15.4	5.20
	A_2	2–8	2.1	4.3	15.3	13.8	6.1	43.5	14.9	56.5	Loam	(2)	29.8	7.3	2.07
	A_3	8–16	3.0	5.1	13.7	13.5	5.6	44.4	14.7	68.5	Loam	(2)	29.0	6.1	.90
	B_3	16–22	4.0	6.1	14.6	12.2	5.2	44.1	13.8	82.2	Loam	(2)	24.2	5.5	.90
	C_1	22–29	4.4	6.5	14.9	13.8	5.4	43.0	12.0	77.8	Loam	(2)	24.1	5.9	.71
Drifton very stony loam; S57Pa.13–14; on Broad Mountain, west of Route 29	A_0	2½–0	------	------	------	------	------	------	------	------	------	(2)	62.8	41.0	25.88
	A_1	0–6	1.0	6.4	15.3	13.4	6.7	43.0	14.2	17.7	Loam	(2)	29.4	10.1	5.35
	A_2	6–10	1.1	5.2	2.8	10.8	5.4	55.8	18.9	9.5	Silt loam	(2)	28.1	8.1	1.43
	B_1	10–14	.9	5.2	12.1	9.5	5.0	43.5	23.8	19.5	Loam	(2)	28.3	10.2	.95
	B_{21g}	14–21	.1	4.5	10.5	9.4	4.7	43.6	26.2	17.9	Loam	(2)	27.1	11.0	.48
	B_{22g}	21–25	.7	3.4	8.3	7.3	4.4	48.4	27.5	9.0	Clay loam	(2)	27.7	11.5	.27
	B_{23g}	25–30	1.7	5.8	10.8	6.9	6.8	45.4	22.6	20.8	Loam	(2)	24.8	9.5	.24
	B_3	30–33	1.4	6.4	13.1	10.2	5.4	43.8	19.7	24.7	Loam	(2)	22.3	7.7	.26
	C_1	33–41	2.0	7.3	15.7	13.5	6.4	41.0	14.1	19.2	Loam	(2)	19.0	5.9	.17

See footnotes at end of table.

eight of the main soils in Carbon County

sample not taken or material not present]

Organic carbon	Nitrogen	Carbon-nitrogen ratio	Extractable cations (milliequivalents per 100 grams of soil)					Total cation-exchange capacity (NH_4AC)	Base saturation	pH	Relative composition of the clay fraction [1]			
			Hydrogen	Calcium	Magnesium	Potassium	Sodium				Kaolinite	Illite	Chlorite	Vermiculite
Percent	*Percent*								*Percent*					
1.59	0.102	15.5	8.2	7.6	1.0	0.3	0.2	10.0	91	5.9	Moderate	Moderate	Moderate	
.31	.086	3.6	6.6	4.3	.9	.2	.2	8.5	66	5.4	Abundant	Abundant	Moderate	
.14	.052	2.7	9.7	3.2	.6	.2	.2	8.3	51	4.9	Dominant	Abundant	Moderate	Trace+.
.11	.044	2.5	9.5	2.9	.5	.5	.2	8.8	47	4.9	Dominant	Abundant	Moderate	Trace+.
.11	.058	2.1	12.7	1.8	.6	.2	.2	11.9	24	4.8	Dominant	Abundant	Moderate	Trace+.
.11	.044	2.5	16.7	.8	.4	.2	.2	15.5	10	4.6	Dominant	Abundant	Moderate	Trace+.
.13	.0384	3.4	17.4	.5	.4	.2	.1	16.8	7	4.7	Dominant	Abundant	Moderate	Trace+.
1.48	.164	9.0	3.5	7.7	.5	.3	.3	9.8	90	6.8	Moderate	Abundant	Low	
1.01	.119	8.5	3.0	6.0	.4	.3	.2	9.0	77	6.8	Moderate	Abundant	Moderate	
.53	.084	6.3	2.9	4.8	.4	.3	.2	9.1	63	6.7	Abundant	Abundant	Moderate	Trace.
.67	.076	5.2	3.4	4.7	.6	.2	.2	9.6	59	6.7	Abundant	Abundant	Moderate	Trace+.
.32	.086	3.7	3.9	3.9	.7	.2	.2	9.7	52	6.5	Abundant	Abundant	Low	Trace+.
.23	.064	3.6	5.3	3.9	2.6	.2	.2	12.6	55	6.2	Dominant	Abundant	Moderate	Trace.
.11	.072	1.5	5.2	1.4	1.5	.2	.2	9.2	36	5.1	Dominant	Abundant	Low	Trace.
2.15	.1685	12.8	9.2	4.8	1.0	.2	.2	9.9	63	5.6	Moderate	Moderate	Low	
.50	.0593	8.4	7.1	1.5	.3	.1	.1	6.2	32	5.0	Moderate	Abundant	Low	
.18	.0543	3.3	6.2	1.5	.1	.1	.1	9.5	19	5.0	Abundant	Abundant	Low	
.06	.0326	1.8	6.4	1.2	.5	.1	.1	5.7	33	4.9	Abundant	Abundant	Low	
.04	.0360	1.1	7.7	.9	.3	.1	.1	6.3	22	4.8	Abundant	Dominant	Low	
.16	.0392	4.1	8.6	.9	.4	.1	.1	7.0	21	4.7	Abundant	Dominant	Low	
1.55	.1256	12.3	2.1	6.6	.4	.2	.3	12.7	59	6.3	Abundant	Abundant	Moderate	
.30	.0373	8.0	5.6	1.4	.9	.2	.2	9.6	28	5.5	Dominant	Abundant	Low	
.21	.0377	5.6	7.0	.9	.1	.1	.2	7.4	18	5.0	Dominant	Abundant	Low	
.10	.0381	2.6	6.5	.7	.2	.1	.2	8.7	14	4.7	Abundant	Abundant	Low	
.06	.0412	1.5	8.0	.6	.4	.1	.2	9.3	14	4.7	Abundant	Abundant	Low	
.04	.0321	1.2	6.9	.5	.4	.1	.2	8.4	14	4.6	Abundant	Abundant	Low	
.05	.0360	1.4	7.0	.4	.5	.2	.1	7.8	15	4.6	Abundant	Abundant	Low	
7.92	.464	17.1	28.8	2.1	.7	.4	.2	29.1	12	3.8				
2.14	.110	19.0	15.0	.3	.2	.2	.2	13.8	6	4.0	Moderate	Moderate	Moderate	
.73	.064	11.1	8.7	.3	.1	.1	.2	9.0	8	4.5	Low	Low	Moderate	
.20	.033	6.0	4.7	.0	.3	.1	.2	8.0	8	4.5	Moderate	Moderate	Moderate	
.05	.031	1.6	5.5	.1	.3	.1	.2	9.1	8	4.5	Abundant	Abundant	Moderate	
.04	.024	1.6	4.8	.1	.3	.1	.2	9.8	7		Moderate	Moderate	Moderate	
8.32	.411	20.2		3.1	.7	.3	.2	33.1	13	5.0				
3.02	.185	16.3	15.8	.5	.6	.2	.2	14.1	11	4.7	Moderate	Low	Abundant	
1.20	.083	14.4	8.6	.1	.7	.2	.2	8.6	14	4.6	Moderate	Moderate	Abundant	
.52	.068	8.1	7.3	.1	.5	.1	.2	9.4	10	4.7	Abundant	Moderate	Abundant	
.52	.047	11.0	6.3	.2	.4	.1	.2	7.9	11	4.6	Abundant	Moderate	Abundant	
.41	.050	8.2	6.9	.3	.5	.1	.2	8.0	14	4.7	(2)	(2)	(2)	
15.01	.395	38.0		3.9		.6	.5							
3.10	.149	20.9	16.7	.4	.4	.2	.2	17.7	7	3.9	Low	Moderate	Low	
.84	.065	13.0	7.3	.1	.3	.2	.2	8.3	10	4.2	Moderate	Moderate	Moderate	
.55	.053	10.4	8.3	.1	.3	.1	.2	8.2	9	4.6	Abundant	Moderate	Moderate	
.28	.039	7.2	8.9	.1	.1	.1	.2	11.5	4	4.6	Abundant	Abundant	Low	
.16	.034	4.7	10.0	.2	.3	.1	.2	12.8	6	4.6	Abundant	Abundant	Low	
.14	.030	4.7	7.8	.2	.3	.1	.2	10.2	8	4.7	Abundant	Abundant	Low	
.15	.033	4.6	6.8	.2	.3	.1	.2	9.7	8	4.8	Abundant	Abundant	Low	
.10	.023	4.3	4.5	.2	.3	.1	.2	7.5	11	4.8	Moderate	Moderate	Low	

TABLE 9.—*Soil characterization data for eight*

Soil type, sample number, and location of sample site	Horizon	Depth from surface	Particle-size distribution							Coarse fragments (greater than 2 mm.)	Textural class	Bulk density	Moisture held at—		Organic matter
			Very coarse sand (2 to 1 mm.)	Coarse sand (1 to 0.5 mm.)	Medium sand (0.5 to 0.25 mm.)	Fine sand (0.25 to 0.10 mm.)	Very fine sand (0.10 to 0.05 mm.)	Silt (0.05 to 0.002 mm.)	Clay (less than 0.002 mm.)				Tension of ⅓ atmosphere	Tension of 15 atmospheres	
		Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*		*G. per CC.*	*Percent*	*Percent*	*Percent*
Drifton very stony loam; S57Pa.13–15; 4 miles east of Jim Thorpe, along Route 903.	A_1	0–3	1.3	4.1	19.6	23.3	8.7	34.6	8.4	9.1	Fine sandy loam.	(2)	25.4	8.0	4.04
	A_2	3–8	2.0	10.9	29.6	5.6	1.8	33.6	16.5	10.5	Loam	(2)	20.0	9.3	2.02
	B_1	8–13	2.4	6.8	28.7	8.4	2.6	34.8	16.3	24.0	Loam	(2)	23.8	7.8	.58
	B_{21}	13–19	3.2	10.6	29.9	5.1	1.8	34.7	14.7	20.5	Loam	(2)	21.6	6.6	.20
	B_{22}	19–28	3.6	14.1	26.4	4.3	2.0	41.5	8.1	32.5	Loam	(2)	20.9	8.2	.00
	B_3	28–33	3.0	5.6	16.6	17.6	6.8	41.4	9.0	34.1	Loam	(2)	17.7	3.8	.00
	C_1	33–40	3.6	4.7	13.3	17.0	6.7	44.9	9.8	34.2	Loam	(2)	18.6	4.4	.00
Hartleton channery silt loam; S57Pa.13–1; 4 miles east of Weissport, north of U.S. Highway 209.	A_p	0–8	3.8	2.8	2.8	15.3	14.1	45.9	15.3	52.0	Loam		23.63	7.63	2.58
	B_1	8–13	9.3	6.5	5.3	17.9	13.3	33.2	14.5	69.3	Fine sandy loam.		16.33	7.21	.77
	B_{21}	13–20	10.8	6.8	6.1	22.4	15.5	25.9	12.5	79.8	Fine sandy loam.		16.15	6.68	.48
	B_{22}	20–28	9.8	5.9	5.3	25.9	19.6	25.4	8.1	74.8	Fine sandy loam.		9.99	4.75	.19
	B_3	28–32	10.9	5.8	4.2	23.3	20.4	29.4	6.0	76.1	Fine sandy loam.		12.14	3.96	.07
	C_1	32–40	9.9	6.9	4.9	20.9	17.4	33.7	6.3	72.0	Fine sandy loam.		13.51	3.92	.09
Hartleton channery silt loam; S57Pa.13–8; 4 miles southwest of Lehighton.	A_p	0–10	11.8	8.9	4.0	3.0	2.8	51.4	18.1	67.7	Silt loam		26.33	11.0	4.17
	B_1	10–14	9.6	5.6	1.6	1.0	1.1	55.5	25.6	75.1	Silt loam		26.67	10.7	.71
	B_{21}	14–23	8.4	5.0	1.4	.8	1.2	56.4	26.8	72.1	Silt loam		28.67	11.7	.48
	B_{22}	23–27	12.1	6.4	1.6	.9	1.7	57.9	19.4	81.3	Silt loam		27.08	9.5	.36
	B_3	27–32	14.6	11.0	1.8	.7	1.5	45.6	24.8	90.0	Loam		21.08	8.9	.27
	C_1	32–39	9.6	10.5	2.8	1.7	2.0	52.1	21.3	85.2	Silt loam		22.08	7.9	.25
Hazleton very stony loam; S57Pa.13–9; top of Broad Mountain, along U.S. Highway 209.	A_0	1–0											97.5	15.1	39.95
	A_1	0–3	.6	4.6	15.7	8.9	5.5	42.7	21.8	49.6	Loam		34.2	14.2	6.39
	A_2	3–7	.8	4.7	14.9	9.3	5.2	42.8	22.3	58.8	Loam		32.9	11.4	5.22
	A_3	7–11	1.0	5.0	15.0	8.5	5.4	42.7	22.4	57.5	Loam		35.9	11.7	5.14
	B_{21}	11–20	3.2	6.6	11.1	12.7	4.8	46.1	15.5	40.1	Loam		24.0	9.4	.75
	B_{22}	20–30	3.0	7.6	17.3	9.4	5.8	41.5	15.4	37.0	Loam		21.9	8.0	.14
	B_3	30–38	3.1	7.6	17.3	11.4	6.6	36.6	17.4	38.2	Loam		19.0	8.6	.10
	C_1	38–44	2.5	11.6	20.9	6.7	4.5	40.3	13.5	39.8	Loam		15.1	8.2	.36
Hazleton very stony loam; S57Pa.13–16; 3 miles north of Jim Thorpe, in Penn Forest Township.	A_1	0–4	.5	2.4	22.6	19.6	5.8	34.2	14.9	44.9	Loam		31.5	9.8	5.61
	A_2	4–10	.9	2.8	13.5	17.1	6.7	43.3	15.7	29.0	Loam		28.4	8.9	1.37
	B_1	10–15	.9	2.8	13.0	16.7	6.5	41.5	18.6	18.5	Loam		23.7	8.2	.55
	B_{21}	15–20	2.3	3.6	11.9	17.4	6.5	43.1	15.2	30.5	Loam		21.8	7.7	.27
	B_{22}	20–27	1.3	2.4	12.8	18.9	7.8	37.5	19.3	15.6	Loam		21.2	7.8	.14
	B_{23}	27–33	1.1	2.2	12.0	18.2	8.7	27.9	29.9	10.5	Clay loam		22.4	12.3	.17
	B_3	33–43	.8	2.7	11.2	15.8	8.2	24.9	36.4	11.2	Clay loam		22.9	15.0	.19
	C_1	43–50	1.5	4.3	18.9	19.4	8.9	24.4	22.6	8.3	Sandy clay loam.		21.1	10.4	.12
Klinesville channery silt loam; S57Pa.13–4; along route 13016, 1½ miles south of U.S. Highway 209.	A_p	0–5	14.4	11.2	5.3	9.2	4.1	38.9	16.9	74.0	Loam		23.20	8.7	3.50
	B_3	5–13	22.4	16.3	5.5	2.9	2.6	35.4	14.9	39.4	Loam		21.60	7.0	1.17
	C_1	13–20	21.7	16.9	7.2	4.7	3.4	33.7	12.4	92.4	Coarse sandy loam.		19.96	6.2	1.08
	C_2	20–28	25.6	17.4	6.5	4.2	3.3	31.7	11.3	90.3	Coarse sandy loam.		20.37	6.4	1.32
Klinesville channery silt loam; S57Pa.13–6; 1 mile south of Towamensing Township Elementary School.	A_p	0–4	17.7	16.4	8.9	6.0	3.6	34.9	12.5	66.2	Coarse sandy loam.		26.56	9.5	5.87
	B_3	4–13	17.9	17.7	10.1	6.3	3.4	30.6	14.0	83.8	Coarse sandy loam.		23.77	8.1	4.22
	C_1	13–18	(2)	(2)	(2)	(2)	(2)	(2)	12.0	96.5	(2)		(2)	(2)	1.87

See footnotes at end of table.

of the main soils in Carbon County—Continued

Organic carbon	Nitrogen	Carbon-nitrogen ratio	Extractable cations (milliequivalents per 100 grams of soil)					Total cation-exchange capacity (NH_4AC)	Base saturation	pH	Relative composition of the clay fraction [1]			
			Hydrogen	Calcium	Magnesium	Potassium	Sodium				Kaolinite	Illite	Chlorite	Vermiculite
Percent	*Percent*								*Percent*					
2.34	.114	20.6	16.4	0.3	0.2	0.2	0.2	13.7	7	4.2	Low	Moderate	Low	
1.17	.090	13.0	13.3	.0	.3	.2	.2	10.8	6	4.8	Moderate	Moderate	Moderate	
.34	.048	7.1	7.5	(3)	.0	.2	.2	7.9	6	4.8	Abundant	Moderate	Moderate	
.12	.030	4.0	6.4	(3)	.2	.2	.2	5.9	12	4.9	Moderate	Moderate	Low	
.00	.021	.0	5.3	.3	.4	.1	.2	5.9	17	5.0	Abundant	Moderate	Low	
.00	.018	.0	5.1	.0	.1	.1	.1	5.1	6	5.0	Moderate	Moderate	Low	
.00	.018	.0	5.0			.1	.1	5.4	7	5.0	Moderate	Moderate	Low	
1.50	.1428	10.5	7.2	4.7	.2	.3	.2	9.2	59	5.5	Moderate	Moderate	Moderate	
.45	.0296	5.7	5.5	3.9	.7	.3	.1	10.4	48	5.5	Moderate	Moderate	Moderate	
.28	.0627	4.5	4.4	2.9	1.2	.2	.1	6.4	69	5.4	Abundant	Abundant	Low	
.11	.0535	2.1	3.3	1.7	.6	.2	.1	4.6	56	5.2	Abundant	Abundant	Low	
.04	.0476	.8	3.0	1.2	.6	.2	.1	3.2	66	4.9	Moderate	Abundant	Low	
.05	.0581	.9	2.8	1.2	.4	.2	.1	3.4	56	4.9	Moderate	Abundant	Low	
2.42	.2393	10.1	8.7	6.6	.7	.4	.3	12.4	64	5.2	Moderate	Moderate	Moderate	
.41	.0649	6.3	3.7	5.6	1.0	.3	.3	10.3	70	6.0	Moderate	Moderate	Moderate	
.28	.0526	5.3	3.7	6.2	.8	.3	.3	12.2	62	6.0	Abundant	Moderate	Moderate	Trace.
.21	.0434	4.8	4.4	4.8	1.0	.2	.3	10.9	58	5.6	Moderate	Moderate	Low	Trace.
.16	.0456	3.5	7.4	1.9	.4	.2	.2	11.2	24	4.8	Moderate	Abundant	Low	Trace.
.15	.0388	3.9	6.8	1.7	.4	.2	.2	9.2	27	4.8	Moderate	Abundant	Low	Trace.
23.17	.1400	165.5								3.7				
3.71	.1851	20.0	24.4	.2	.6	.2	.2	14.4	8	4.3	Low	Low	Moderate	
3.03	.1290	23.5	15.9	.2	.3	.2	.2	13.1	7	4.5	Low	Low	Moderate	
2.98	.1208	24.7	15.9	.2	.4	.2	.2	11.6	9	4.4	Low	Low	Moderate	
.44	.0411	10.7	8.8	(3)	.3	.1	.2	5.0	12	4.5	Moderate	Moderate	Moderate	
.08	.0176	4.5	7.2	.2	.3	.1	.1	5.3	13	4.8	Moderate	Abundant	Low	
.06	.0155	3.9	6.2	(3)	.3	.1	.2	6.1	10	5.0	Moderate	Moderate	Low	
.21	.0192	10.9	6.9	.1	8.3	.1	.2	5.8	12	5.0	Moderate	Abundant	Low	
3.25	.1630	19.9	24.8	.4	.3	.2	.1	20.7	5	4.1	Moderate	Moderate	Low	
.79	.0540	14.6	9.5	(3)	.2	.2	.2	10.9	6	4.7	Moderate	Moderate	Low	
.32	.0330	9.7	6.8	.1	.2	.1	.2	10.3	6	4.6	Abundant	Moderate	Moderate	
.16	.0288	5.6	6.5	(3)	.1	.1	.2	10.0	4	4.5	Dominant	Abundant	Moderate	
.08	.0215	3.7	6.1	.2	.3	.1	.2	8.7	9	4.7	Abundant	Abundant	Moderate	
.10	.0252	4.0	6.7	.6	.5	.1	.2	11.8	12	5.1	Abundant	Moderate	Low	
.11	.0297	3.7	9.4	(3)	.6	.2	.2	13.9	7	5.1	Moderate	Moderate	Low	
.07	.0252	2.8	7.5	(3)	.4	.1	.1	9.9	6	4.9	Dominant	Dominant	Low	
2.03	.1736	11.7	8.2	2.8	.3	.3	.2	8.4	43	5.2	Moderate	Moderate	Moderate	
.68	.0912	7.5	3.7	1.8	.3	.3	.2	5.6	46	5.7	Moderate	Moderate	Moderate	
.63	.0888	7.1	3.3	2.2	.5	.3	.2	6.5	49	5.9	Moderate	Moderate	Low	
.77	.1004	7.7	3.1	2.3	.4	.3	.2	6.1	52	5.8	Moderate	Moderate	Low	
3.40	.2900	11.7	4.1	12.3	1.0	.7	.4	19.7	98	6.6	Moderate	Moderate	Low	
2.45	.2211	11.1	4.1	9.3	.6	.5	.3	11.2	95	6.5	Moderate	Abundant	Low	
1.08	(3)	(2)	2.6							6.6	Moderate	Abundant	Low	

TABLE 9.—*Soil characterization data for eight*

Soil type, sample number, and location of sample site	Horizon	Depth from surface	Particle-size distribution							Coarse fragments (greater than 2 mm.)	Textural class	Bulk density	Moisture held at—		Organic matter
			Very coarse sand (2 to 1 mm.)	Coarse sand (1 to 0.5 mm.)	Medium sand (0.5 to 0.25 mm.)	Fine sand (0.25 to 0.10 mm.)	Very fine sand (0.10 to 0.05 mm.)	Silt (0.05 to 0.002 mm.)	Clay (less than 0.002 mm.)				Tension of ⅓ atmosphere	Tension of 15 atmospheres	
		Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*		*G. per CC.*	*Percent*	*Percent*	*Percent*
Montevallo channery silt loam; S57Pa.13–3; along route 13016, 1 mile south of U.S. Highway 209.	A_p	0–5	15.3	10.6	4.2	2.4	4.8	45.8	16.9	82.4	Loam		28.56	11.0	5.09
	B_3	5–12	(2)	(2)	(2)	(2)	(2)	(2)	19.0	97.9			(2)	(2)	3.59
	C_1	12–23	(2)	(2)	(2)	(2)	(2)	(2)	15.0	98.1			(2)	(2)	3.17
Montevallo channery silt loam; S57Pa.13–5; one-half mile west of Jonesville.	A_p	0–6	10.6	5.2	2.5	2.6	7.0	55.3	16.8	76.8	Silt loam		35.34	12.4	86.85
	B_3	6–16	16.1	12.1	3.7	1.9	3.8	41.7	20.7	93.1	Loam		27.95	11.6	2.77
	C_1	16–22	42.9	15.9	4.0	1.0	1.6	19.5	15.1	94.2	Coarse sandy loam.		15.38	9.1	1.68
Watson silt loam; S57-Pa.13–11; 3 miles west of Hudsondale.	A_p	0–8	2.0	2.6	2.9	10.3	19.1	48.4	14.7	15.2	Loam	1.50	24.1	7.7	2.12
	B_1	8–12	2.5	2.8	2.5	7.5	13.6	44.2	26.9	24.1	Loam	1.58	24.5	11.1	.62
	B_{21}	12–18	3.0	2.8	5.5	7.5	13.4	41.1	26.7	22.6	Loam	1.67	24.5	11.6	.36
	B_{22g}	18–22	1.3	1.6	1.8	6.8	12.8	56.2	19.5	20.9	Silt loam	1.78	23.0	9.5	.19
	B_{23g}	22–30	2.2	2.8	3.0	9.4	16.2	46.8	19.6	18.0	Loam	1.78	22.5	8.9	.14
	B_{24g}	30–36	2.2	2.6	2.8	9.4	16.0	43.8	23.2	17.5	Loam	1.83	23.2	8.9	.10
	B_3	36–41	1.6	2.7	3.1	9.6	18.7	41.1	23.2	14.5	Loam		23.3	9.7	.10
	C_1	41–53	1.9	3.3	3.5	10.2	18.4	43.3	19.4	20.3	Loam		23.9	8.5	.09
Watson silt loam; S57-Pa.13–13; on Carbon County Institutional Farm, Lehigh Township.	A_p	0–10	1.3	1.9	2.8	6.1	14.5	58.0	14.8	13.4	Silt loam	1.37	29.4	7.5	2.65
	B_1	10–14	2.9	2.8	2.8	5.6	11.6	54.7	19.6	12.5	Silt loam	1.71	23.9	8.6	.43
	B_{21}	14–19	2.4	2.8	2.7	5.4	11.6	52.7	22.3	16.7	Silt loam	1.65	25.0	9.5	.34
	B_{22g}	19–24	2.2	2.5	2.7	5.3	10.9	57.1	19.3	13.5	Silt loam	1.62	25.2	8.7	.25
	B_{23g}	24–30	1.4	2.0	2.7	4.9	10.1	59.9	19.0	19.6	Silt loam	1.74	26.0	8.0	.16
	B_3	30–36	1.1	1.5	2.2	4.5	8.9	62.1	19.7	15.9	Silt loam	1.72	24.8	8.5	.12
	C_1	36–48	1.4	2.3	3.9	6.0	9.4	58.3	18.7	25.4	Silt loam		26.51	4.1	.12

[1] Relative ratings in one profile apply only to conditions in that profile and may not mean the same in another profile.
[2] Not determined, generally because of the lack of fine soil in samples that consisted mainly of coarse fragments.

ALLENWOOD GRAVELLY SILT LOAM

Four samples of Allenwood soils were analyzed. Samples S57Pa.13–2 and S57Pa.13–7 of this soil type contained a large proportion of stones throughout the profiles. The upper horizons contained less than the lower horizons because the softer gravel had weathered to soil. These samples showed a distinct increase in clay in the B horizon. Both profiles showed the effects of liming. The area from which sample S57Pa.13–7 was taken had been limed heavily and more recently, and the pH in that sample was close to neutral to a depth of more than 32 inches.

Samples S57Pa.13–10 and S57Pa.13–12 contained much gravel from local siltstone and soft sandstone. Sample S57Pa.13–12 did not show an increase in clay in the B horizon. This probably indicates that, on moderately eroded sites, part of the B horizon has been mixed with the A horizon.

The clay minerals in the samples tested were found to be medium to very high in kaolinite, medium to high in illite, and low to medium in chlorite-like material. The clay minerals in samples S57Pa.13–2 and S57Pa.13–7 were low in vermiculite below a depth of 15 inches.

The clay minerals reflect, in part, the degree of weathering. They also show some influence of the various types of gravel that make up the parent material. This is particularly true in sample S57Pa.13–7. The soil from which this sample was taken appears to have formed in outwash of the Illinoian glacier.

DEKALB VERY STONY LOAM

Two samples of Dekalb very stony loam were analyzed. Both samples contained a large number of coarse fragments as big as large boulders. The proportion of boulders in the soil is actually higher, however, than that shown by laboratory analyses of the two samples because some boulders were excluded in sampling. The fine materials range from loam to sandy loam. All horizons were found to be low in clay.

In the Dekalb very stony loams that were sampled, the supply of organic matter was found to be low except in the A_0 and A_1 horizons. The site from which both samples were taken had been burned over many times, and the soils have recognizable bits of charcoal on the surface and in the upper horizons. Calcium and magnesium are extremely low. The cation-exchange capacity of the mineral soil is very low. The available moisture-holding capacity is average for the fine material. However, in both profiles, when the high proportion of coarse material and the thinness of the total solum are considered, the moisture-holding capacity is low.

of the main soils in Carbon County—Continued

Organic carbon	Nitrogen	Carbon-nitrogen ratio	Extractable cations (milliequivalents per 100 grams of soil)					Total cation-exchange capacity (NH_4AC)	Base saturation	pH	Relative composition of the clay fraction [1]			
			Hydrogen	Calcium	Magnesium	Potassium	Sodium				Kaolinite	Illite	Chlorite	Vermiculite
Percent	*Percent*								*Percent*					
2.95	.2572	11.5	9.0	2.6	0.5	0.3	0.2	10.9	33	5.2	Moderate	Moderate	Moderate	
2.98	(2)		9.9	3.1	.9	.2	.2			4.9	Moderate	Moderate	Moderate	
1.84	(2)		8.5							4.9	Abundant	Moderate	Abundant	
3.97	.2996	13.3	12.2	9.1	.7	.4	.4	16.8	63	5.6	Low	Moderate	Abundant	
1.61	.1421	11.3	6.3	5.1	.3	.4	.3	11.0	55	6.1	Moderate	Moderate	Abundant	
.97	.0998	9.7	2.7	3.2	.3	.3	.2			6.2	Abundant	Moderate	Abundant	
1.23	.1125	10.9	5.4	5.0	.6	.2	.2	8.3	72	6.3	Abundant	Abundant	Low	
.36	.5310	6.8	7.1	1.2	.7	.1	.1	7.2	29	5.3	Dominant	Abundant	Low	
.21	.0353	5.9	7.6	1.4	.8	.1	.1	6.7	36	5.0	Dominant	Dominant	Low	
.11	.0262	4.2	5.0	.9	.5	.1	.1	6.2	26	5.0	Dominant	Dominant	Low	
.08	.0317	2.5	4.6	.7	.5	.1	.1	5.4	26	4.9	Dominant	Dominant	Moderate	
.06	.0314	1.9	4.3	.8	.4	.2	.1	7.9	19	4.9	Dominant	Abundant	Low	
.06	.0262	2.3	3.8	.2	.4	.2	.1	6.9	13	4.8	Dominant	Dominant	Low	
.05	.0251	1.9	3.5	(3)	.3	.1	.1	7.4	7	4.9	Dominant	Dominant	Low	
1.54	.1350	11.4	5.4	5.6	.8	.2	.3	11.8	58	5.8	Moderate	Moderate	Low	
.25	.0394	6.3	2.2	4.9	1.0	.2	.3	9.4	68	6.4	Abundant	Abundant	Low	
.20	.0368	5.4	3.2	3.2	1.0	.2	.3	9.6	49	6.5	Abundant	Abundant	Low	
.15	.0296	5.1	3.9	2.5	1.8	.2	.3	9.7	49	5.9	Abundant	Abundant	Low	
.09	.0256	3.5	5.0	1.0	.8	.2	.2	10.7	21	5.0	Abundant	Moderate	Low	
.07	.0252	2.8	6.0	.8	1.0	.2	.2	10.6	21	4.8	Abundant	Moderate	Low	
.07	.0263	2.7	9.9	.3	.5	.2	.1	14.2	8	4.7	Abundant	Low	Moderate	

[3] Less than 0.1.

The clay minerals in sample S57Pa.13–21 were found to be low in kaolinite, illite, and chlorite-like material. Those in sample S57Pa.13–22 were found to be medium in kaolinite and illite and high in chlorite-like material. Vermiculite was not present.

Drifton Very Stony Loam

Two samples of Drifton very stony loam were analyzed. This soil type is characterized by moderate amounts of coarse fragments in the solum. The coarse fragments increase rapidly in quantity in the C horizon. The texture is loamy, but one profile showed a concentration of medium-sized sand, and the other, a more normal distribution of all sizes of sand. Profile S57Pa.13–15 showed an increase of clay in the A_2 horizon, and profile S57Pa.13–14, a moderate increase in the A_2 and B horizons.

In the Drifton very stony loams tested, the supply of organic matter was low in the subsoil and very low in the gleyed pan horizon at a depth below about 18 inches. The carbon-nitrogen ratio in the surface layer was found to be very high, probably because of frequent burning of the site. The cation-exchange capacity was medium to low, but the content of bases was very low, resulting in a high degree of unsaturation and very strong acidity.

The clay minerals in profile S57Pa.13–15 were found to be medium in kaolinite and illite. They were medium in chlorite-like material at a depth of 3 to 13 inches but were low at other depths. In profile S57Pa.13–14, the clay minerals were found to be medium to high in kaolinite and illite; they were low in chlorite-like material, except at a depth of 6 to 14 inches, where they were medium.

Hartleton Channery Silt Loam

Two samples of Hartleton channery silt loam were analyzed. In this soil type, there is a high proportion of fragments of fine sandstone and siltstone in the profile. The fragments are as much as 3 inches in diameter but are mainly less than 1 inch in diameter. Both samples were found to contain considerable very coarse sand, mostly particles of shale and siltstone. Analyses of sample S57Pa.13–8 showed the texture to be silt loam, except for one horizon of loam. This sample showed some increase in clay from the A to the B horizon. Both profiles were found to be low in clay.

The coarse fragments prevented the determination of bulk density in these soils. The moisture-holding capacity was found to be relatively low, particularly in the lower horizons of sample S57Pa.13–1.

The plow layer and the subsoil in sample S57Pa.13–8 were found to be fairly high to high in organic matter.

The carbon-nitrogen ratio was low in both samples. Total cation-exchange capacity of the fine material was near average for soils in the county. However, the high proportion of coarse fragments makes the capacity throughout the entire solum fairly low. The base saturation with calcium is moderate, probably because of liming.

Clay minerals in the Hartleton channery silt loams sampled were found to be medium to high in kaolinite and illite and medium to low in chlorite-like material. In some, but not all, horizons they were low in vermiculite.

Hazleton Very Stony Loam

Two samples of Hazleton very stony loam were analyzed. Both samples contained a moderate amount of coarse fragments of sandstone, as determined in the laboratory. In addition, many boulders were discarded when the samples were collected. Sample S57Pa.13–9 contained more coarse fragments of all sizes than sample S57Pa.13–16. Analysis showed the texture of both profiles to be loam, but sample S57Pa.13–16 had an abrupt increase in clay and a corresponding decrease in silt in horizons below a depth of 27 inches. This suggests that the parent material for these horizons was more shaly than that of the upper horizons.

The moisture-holding capacity was moderate in the Hazleton very stony loams tested. The supply of organic matter was found to be low, except that the soils tested contained some charcoal. The soils are strongly acid. The base exchange capacity was found to be low, and the degree of saturation with bases, very low.

The clay minerals in sample S57Pa.13–9 were medium in kaolinite, medium to high in illite, and low to medium in chlorite-like material. In sample S57Pa.13–16, the clay minerals were medium to high in kaolinite and low to medium in chlorite-like material.

Klinesville Channery Silt Loam

Two samples of Klinesville channery silt loam that had been cultivated were analyzed. In this soil type, there is a very high proportion of coarse fragments throughout the solum. The fine material is loam to coarse sandy loam, in which the coarse and very coarse sand fractions contain a high proportion of fragments of shale and siltstone. The content of clay is low in all horizons.

In the samples tested, the available moisture-holding capacity of the fine material was found to be about average, but the large proportion of coarser material made the total moisture-holding capacity very low. The supply of organic material was found to be moderately high throughout the profile; the carbon-nitrogen ratio in the surface layer was moderately low.

Sample S57Pa.13–4 had a moderate degree of base saturation, mostly with calcium. The site from which this sample was taken had been idle for some time. About 75 percent of sample S57Pa.13–6 was saturated with bases, mostly calcium. The site from which this sample was obtained had been used for pasture but was only partly covered by vegetation. The high pH indicates that the soil had been well limed.

In the Klinesville channery silt loams that were analyzed, clay minerals were mostly found to be medium in kaolinite and illite and low to medium in chlorite-like material. Vermiculite was not in the soil.

Montevallo Channery Silt Loam

Two samples of Montevallo channery silt loam were analyzed. The samples were obtained in idle fields. This soil type is essentially a Lithosol that contains a very high proportion of coarse fragments. The texture of the fine material ranges from silt loam to coarse sandy loam, depending on the proportion of partly weathered fragments of shale and siltstone in the sand and very coarse sand.

In the samples tested, the moisture-holding capacity of the fine material was found to be average. However, the high proportion of coarse fragments caused the total moisture-holding capacity to be very low. The supply of organic matter was found to be high. The carbon-nitrogen ratio was moderately low. The cation-exchange capacity was fairly high for the fine material, and the degree of base saturation was moderate to moderately low, reflecting past liming practices.

The clay minerals in the samples tested were medium in kaolinite and illite and medium to high in chlorite-like material. Vermiculite was not present.

Watson Silt Loam

Two samples of Watson silt loam were analyzed. This soil type contains coarse fragments in moderate amounts. In profile sample S57Pa.13–13, the texture is silt loam. Analysis showed that there had been a moderate increase in clay from the A to the B horizon. It was determined that the texture of sample S57Pa.13–11 was loam because it contained more very fine sand and a little less silt, except in the B_{22g} horizon.

The bulk density was found to be high in the soils sampled, particularly in the gleyed horizon in the lower subsoil. The available moisture-holding capacity was high, because the upper 36 inches of soil can hold 9 inches of water. The supply of organic matter was moderate. The carbon-nitrogen ratio was narrow. The effect of lime in this soil type is evident in that the upper horizons are slightly acid to moderately acid, and the lower horizons are strongly acid. The cation-exchange capacity, in the samples that were tested, was found to be low, and the degree of base saturation, very low except in horizons affected by lime.

The clay minerals were found to be medium to high in kaolinite and illite and low in chlorite-like material.

Additional Facts About Carbon County

This section provides general information about the early history and the agriculture of Carbon County. The statistics used are from reports published by the U.S. Bureau of the Census.

Early history

Gnaden Hüetten, the first settlement in the county, was near the mouth of Mahoning Creek. It was established by Moravian missionaries in 1742. This settlement was destroyed in 1755. The infamous Walking Purchase and similar abuses upset the otherwise friendly relations with neighboring tribes of Indians (*4*, *28*). The last Indians left the area that is now Carbon County a

ittle more than 200 years ago. The land which is now Carbon County was purchased for 500 pounds.

An early settler described this area as a vast wilderness. This is the literal translation of the word "Towamensing," the name of a township in southeastern Carbon County. The area in the mountains toward the north, now called Pine Swamp, was known as the Shades of Death because refugees became lost and perished in the forests and swamps.

Carbon County was organized in 1843 from parts of Northampton and Monroe Counties. In 1850, the total population was 15,686. By 1950, the population had increased to 57,558.

Coal was discovered at Summit Hill in 1791. This resource and the vast stands of timber opened the area to exploitation. In 1818, the Lehigh Coal and Navigation Company built dams in the Lehigh River. In 1820, the same company shipped the first coal to Philadelphia in arks. The arks were used for one trip and then were broken up and the lumber in them was sold.

In 1825, construction of the canal along the Lehigh River was started. Two years later, construction of the famous Switchback Railroad, which was to be used to haul coal from Summit Hill to Philadelphia, was begun. By 1837, other railroads were being built to haul coal.

Around 1804, settlers moved into the lower valleys of Mahoning and Lizard Creeks and started to farm the land. In the areas where coal was mined, farmers supplied fruit, vegetables, dairy products, and meat to the miners. They also furnished hay for the mules that were used to haul coal out of the mines.

About 1838, as railroads came to White Haven, the cutting of white pine began in earnest in large tracts in Penn Forest, Kidder, Lausanne, and Lehigh Townships. Hemlock bark was harvested for use in tanning hides. One of the places where the bark was used was the Lehigh Tannery. After the bark was removed, the hemlock logs were left in the woods to rot, as they were considered to be of little or no value. Near the mines, pine and oak were cut for use in the mines as props. Extensive lumbering continued until 1875, when fire destroyed most of the timber to the Monroe County line. The fire started at the mouth of Mud Run.

From 1857 to about 1877, pig iron was shipped into the county from Berks and other counties for processing. Because of the abundant timber and the availability of charcoal, several iron furnaces were established. Charcoal was produced in the lower part of the county in charcoal kilns. Among other resources in the county was paint ore, which was mined at Bowmanstown and in the Quakake Valley. A slate quarry was located at Aquashicola. It operated during the latter half of the 19th century.

Mills where shingles were produced were operated for a while in Kidder Township, and some of the streams and trails still carry their names. Wintergreen oil and birch oil were distilled for flavoring, and this industry has continued to the present time. Mills where staves were manufactured operated in the vicinity of Mud Run until early in the 20th century. Trout hatcheries, one on Hayes Creek and one on Wild Creek, were established in the early 1900's.

The county has been noted for its scenic beauty and tourist attractions. After the Switchback Railroad was no longer used to haul coal, it was operated for tourists until the 1930's. The Pocono Mountains abound in waterfalls. One of the highest of these is Glen Onoko, above Jim Thorpe.

Agriculture

The number of farms in Carbon County declined from a high of 936 in 1910 to 570 in 1954. During the same period, the land in farms decreased from 96,303 to 57,809 acres. In 1954, the average-sized farm in the county was 101.4 acres, or only a slight increase from the average size in 1910. Most of the changes in the number and size of farms were caused by the increase in the number of specialized farms. These are mainly poultry farms, which require less land than other kinds of farms.

Carbon County has a total area of 259,200 acres. Of this, about 222,050 acres is woodland. In 1954, 57,809 acres was in farms. The acreage in farms was divided as follows:

Cropland harvested	20,059
Cropland used only for pasture	1,945
Cropland not harvested and not pastured	5,069
Woodland pastured	821
Woodland not pastured	22,706
Other pasture	1,149
Farmsteads, roads, etc.	6,060

In the early days, grain was grown mainly for home use. Part of the hay crop was used to feed a few head of livestock, but most of it was sold. Then, there was a gradual shift to livestock farming. This was brought about partly because of greater demand for livestock products. In addition, it was realized that livestock convert grain and roughage efficiently to meat and are, therefore, easier to ship than grain. Gradually, the cropland was used more extensively to produce feed for livestock. The increase in the amount of grain produced is an indication of the growth of the poultry industry, because poultry are fed more grain than are cattle. In Carbon County a greater part of the farm income is derived from poultry and dairy products than from other products.

Before 1930, a few farmers in the county used lime in small amounts. They used even smaller amounts of fertilizer. Manure was the chief soil amendment. However, it was hauled only as far as the nearest field. The price-support and soil-testing programs that were begun in the 1930's helped obtain increased use of lime and fertilizer. Increasing population, competition, and knowledge of farming further stimulated the use of soil amendments. In 1954, about 3,126 tons of commercial fertilizer were applied to 13,776 acres and 2,784 tons of lime were applied to 2,156 acres.

Yields of most crops in the county have increased steadily through the application of lime and fertilizer and through the use of better seed and improved management. The practice in the production of hay has been to grow the hay on the residue of fertilizer that had been applied to other crops. A few farmers apply fertilizer to hay as a topdressing. Recent research on the use of nitrogen fertilizer for grasses indicates that much higher yields of hay can be obtained through fertilization. Table 10 gives the acreage of the principal crops in Carbon County in stated years.

TABLE 10.—*Acreage of the principal crops in stated years*

Crops	1939	1949	1954
	Acres	*Acres*	*Acres*
Corn for all purposes	3, 176	3, 751	4, 343
Harvested for grain	2, 819	3, 330	3, 761
Cut for silage	204	368	493
Wheat threshed or combined	2, 605	3, 453	2, 933
Oats threshed or combined	3, 098	3, 221	4, 130
Barley threshed or combined	291	387	1, 016
Rye threshed or combined	540	201	80
Buckwheat threshed or combined	587	767	314
Soybeans grown for all purposes	100	88	106
Hay crops, total	6, 138	5, 692	5, 414
Alfalfa and alfalfa mixture cut for hay	573	759	796
Clover, timothy, and mixture of clover and grasses cut for hay	5, 315	4, 871	4, 376
Small grains cut for hay	92	25	21
Other hay cut	158	37	221
Irish potatoes harvested for home use or for sale	1, 788	[1] 1, 562	[2] 800
Vegetables harvested for sale	246	291	204
	Number [3]	*Number* [3]	*Number*
Apple trees of bearing age	36, 152	19, 902	12, 390
Peach trees of bearing age	15, 053	8, 324	3, 244
Cherry trees (sweet and sour) of bearing age	2, 262	914	1, 455
Grapevines of bearing age	1, 486	392	527

[1] Does not include acreage for farms with less than 20 bushels harvested.

[2] Does not include acreage for farms with less than 15 bushels harvested.

[3] One year later than year at head of column.

Trends in Land Use

Improvements in agricultural technology have made farming more competitive, generally to the disadvantage of farmers on the less productive soils. Many operators have quit farming or are farming on a part-time basis. Some land has been left idle.

Strip mining has not affected the use of soils for farming, because the mines are generally on stony and wooded soils. The mines, however, have affected about 7,000 acres of woodland. As an industry, lumbering is at a low ebb in the county. There are very few stands of worthwhile timber. Five or six sawmills operate from 1 to nearly 12 months per year. Most areas in trees have little value except for special products.

Increased use of the land for industry and for urban development has had little general effect on the total acreage of land in farms. However, in the Mahoning Valley some industries and a number of real estate developments have been established on farmland along the highways. A greater loss of farmland can be expected in the future. New and relocated highways have also decreased the acreage available for agriculture. The turnpike, which traverses the county from north to south, occupies about 25 acres of land per mile, besides dividing several farms. Most of this highway, however, extends through forests or nonarable land.

About 80 percent of the acreage in woodlands in Carbon County is in large tracts. Most of the woodlands have a good supply of water. As a result, they are used extensively for recreation. Hickory Run State Park, the area near Lake Harmony, and the reservoirs of the Bethlehem Water Authority are examples of recreational and water developments. A number of sportsmen's clubs own or lease land along many of the streams in the county. There is increased competition for land and water rights. Some of the agricultural land along major streams will, no doubt, be affected by such demand.

Technical Assistance Available to Farmers

In the early days of agriculture in Carbon County, farming methods were generally not scientific. When crops became poor, the land was generally rested and new land was cleared. Farmers who owned livestock spread manure on their land. A few farmers cultivated on the contour and rotated crops.

The first interest in promoting agriculture was shown by the organization of an agricultural society in 1858. Not until 1917 was an office established to advise farmers on improving their methods. At that time the Agricultural Extension program was started to tell farmers about the results of farm research by the State College. The county farm agent maintains an office and a staff to advise farmers on many agricultural subjects. Information is available on all phases of management and soil improvement. Specialists in many fields are available on specific problems.

There is no provision for teaching vocational agriculture in the county. The Agricultural Conservation Program (ACP) has been available to farmers since about 1935. Costs of improving and conserving the soils are shared with the farmer by the Federal government. In addition, technical assistance is available through the Carbon County Soil Conservation District.

Two Federal and four State agencies provide technical assistance to the soil conservation district, through memorandums of understanding. These agencies are the (1) Soil Conservation Service, (2) Forest Service, (3) Pennsylvania Game Commission, (4) Pennsylvania Department of Forests and Waters, (5) Pennsylvania Fish Commission, and (6) Pennsylvania Department of Highways.

Glossary

In this section definitions of technical terms are given for the convenience of readers who cannot refer to them easily elsewhere. Most of the definitions are similar to those in published works on soil science (*15, 16*), soil and moisture conservation (*22*), soil survey (*25*), and other technical publications (*1, 18, 27, 29*).

Aeration, soil. The process by which air and other gases in the soil are renewed. The rate of soil aeration depends largely on the size and number of the pores in the soil and on the amount of water clogging the pores. A soil with many large pores is said to be well aerated.

Aggregate, soil. Many fine soil particles held in a single mass or cluster, such as a clod, crumb, block, or prism.

Alluvial soil. Soil formed from material, such as gravel, sand, silt, or clay, deposited by a stream of water and showing little or no modification of the original material by soil-forming processes.

Anticline. Rock formations folded by lateral pressure into an arch; opposite of syncline.

Base saturation. The relative degree to which a soil has absorbed metallic cations (calcium, potassium, magnesium, etc.). The proportion of the cation-exchange capacity that is saturated with metallic cations.

Bedding, land. Plowing, grading, or otherwise elevating the surface of fields into a series of parallel beds, or "lands," separated by shallow surface drains.

Bedrock. The solid rock that underlies the soils and other unconsolidated material or that is exposed at the surface.

Catena, soil. An association of soils developed from one kind of parent material but differing in characteristics because of differences in drainage or relief.

Channery soil. Soil that contains thin, flat fragments of sandstone, limestone, or schist as much as 6 inches in length along the longer axis. A single piece is called a fragment.

Clean tillage. Cultivation to prevent the growth of all vegetation except the particular crop desired.

Coarse-textured soil. Sand, loamy sand, sandy loam, and fine sandy loam.

Cobblestone. A rounded or partly rounded fragment of rock, 3 to 10 inches in diameter.

Colluvial soil. Soil formed from material that has been moved downhill by gravity, soil creep, frost action, or local erosion. It accumulates on lower slopes and at the bases of slopes.

Conglomerate. Rock composed of gravel and rounded stones cemented together by hardened clay, lime, iron oxide, or silica.

Consistence. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose.—Noncoherent; will not hold together in a mass.

Friable.—When moist, crushes easily under moderate pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger but resistance is distinctly noticeable.

Plastic.—When wet, deformed by moderate pressure, but can be pressed into a lump; will form a wire when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material.

Hard.—When dry, moderately resistant to pressure; can barely be broken between thumb and forefinger.

Cemented.—Hard and brittle; little affected by moistening.

Contour farming. Conducting field operations, such as plowing, planting, cultivating, and harvesting, in rows that are at right angles to the natural direction of the slope and as nearly level as practical.

Cover crop. A close-growing crop grown primarily to improve the soil and protect it between periods of regular crop production, or grown between trees and vines in orchards and vineyards.

Cryoplane terrace. A landform whose surface has been influenced by frost action.

Deciduous trees. Trees that shed their leaves annually; generally refers to the broadleaf trees.

Duff. The matted, partly decomposed organic surface layer on forested soils.

Erodible. Susceptible to erosion; easily lost through the action of water or wind.

Erosion. The wearing away of the land surface by detachment and transport of soil and rock materials through the action of moving water, wind, or other geological agents.

Field moisture capacity. The moisture content of a soil, expressed as percentage of oven-dry weight, after the gravitational or free water has been allowed to drain, usually for 2 or 3 days. The field moisture content 2 or 3 days after a soaking rain. Also called field capacity; normal field capacity; normal moisture capacity; capillary capacity.

Fine-textured soil. Clay loam, sandy clay loam, silty clay loam, sandy clay, silty clay, and clay.

Flood plain. The nearly level land occupying the bottom of the valley of a present stream and subject to flooding unless protected artificially.

Fragipan. A dense and brittle pan, or layer, in soils. It owes its hardness mainly to extreme density or compactness rather than to content of much clay or cementation. Fragments that are removed are friable, but the material in place is so dense that roots cannot penetrate it, and water moves through it very slowly because of the small size of the pores.

Glacial drift. Material of any sort deposited by geological processes in one place after having been removed from another. Glacial drift includes the assorted and unassorted materials deposited by glaciers and by the streams and lakes associated with them.

Glacial outwash. Crossbedded gravel, sand, and silt deposited by meltwater as it flowed from glacial ice.

Glacial till. The unassorted part of glacial drift consisting of clay, silt, sand, and boulders transported and deposited by ice.

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Graded stripcropping. Growing crops in strips that are graded toward a protected waterway.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, and covered by grass to protect it from erosion. Used to conduct surface water away from cropland.

Green-manure crop. Any crop grown for the purpose of being turned under while green, or soon after maturity, to improve the soil.

Gully. A channel or miniature valley cut by running water, but through which water commonly flows only during and immediately after heavy rains or during the melting of snow. Some gullies are dendritic, or branching; others are linear, rather long, narrow, and of uniform width. The distinction between gully and rill is one of depth. A gully is deep enough so that it will not be obliterated by normal tillage operations, whereas a rill is of lesser depth and would be smoothed by ordinary farm tillage.

Hardpan. A cemented (indurated) or hardened soil horizon. This horizon, which may have any texture, is compacted or cemented by iron oxide, silica, organic matter, or other substances.

Horizon, soil. A layer of soil, approximately parallel to the soil surface, with distinct characteristics produced by the soil-forming processes. Horizons are identified by letters of the alphabet.

A horizon.—The horizon at the surface. It contains organic matter, or it has been leached of soluble minerals and clay, or it shows the effects of both. The major A horizon may be subdivided into A_1, the part that is darkest in color because it contains organic matter, and A_2, the part that is the most leached and lightest colored layer in the profile. In woodlands, a layer of organic matter accumulates on top of the mineral soil; this layer is called the A_0 horizon. The depth of the soil, however, is measured from the top of the mineral soil because the A_0 horizon is rapidly destroyed if fire occurs or the soil is cultivated. Where the upper layers of the soil are thoroughly mixed by cultivation, the plowed layer is called the A_p horizon.

B horizon.—The horizon in which clay, minerals, or other material has accumulated, or which has developed a characteristic blocky or prismatic structure, or which shows the characteristics of both processes. It may be subdivided into B_1, B_2, or B_3 horizons. The B_2 horizon may be subdivided further by adding a number to the symbol, such as B_{21}, B_{22}, or B_{23}.

C horizon.—The unconsolidated material immediately under the true soil. It is presumed to be similar in chemical, physical, and mineral composition to the material from which at least part of the overlying solum has developed.

D horizon.—The stratum beneath the parent material. It may be unlike the parent material of the soil. If it consists of solid rock like that from which the parent material has developed, it is designated as D_r.

Gleyed horizon.—A strongly mottled or gray horizon that occurs in wet soils. It is designated by the letters BG, CG, or sometimes by G. A horizon only slightly gleyed may have the subscript letter $_g$ added to the symbol.

Infiltration. The downward entry of water into the soil.

Landscape. The sum total of the characteristics that distinguish a certain kind of area on the earth's surface and give it a distinguishing pattern in contrast to other kinds of areas. Any one kind of soil is said to have a characteristic natural landscape, and under different uses it has one or more characteristic cultural landscapes.

Leached layer. A layer in which the soluble constituents have been dissolved and washed away by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state. In engineering, a high liquid limit indicates that the soil has a high content of clay and a low capacity for carrying loads.

Medium-textured soil. Very fine sandy loam, loam, silt loam, and silt.

Metamorphic rock. A rock that has been greatly altered from its original condition. Heat, pressure, and water are the chief agents in producing metamorphic rock. Igneous or sedimentary rock may be changed to metamorphic rock, or one metamorphic rock may be changed to another. Gneiss, schist, and slate are examples of metamorphic rock.

Mor. A type of forest humus layer that consists of relatively pure, unincorporated organic matter. It is usually matted, or compacted, or both and occurs as a distinct layer above the mineral soil. Means the same as raw humus.

Mottled. Irregular spots of color in soil that vary in number and size. Descriptive terms are: Contrast—*faint, distinct,* and

prominent; abundance—*few*, *common*, and *many*; and size—*fine*, *medium*, and *coarse*. The size measurements are: *Fine*, less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium*, ranging from 5 to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse*, more than 15 millimeters (about 0.6 incl.) in diameter along the greatest dimension.

Parent material. The horizon of weathered rock or partly weathered soil material from which soil has formed; horizon C in the soil profile.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Periglacial. Having a position marginal to, but beyond, the glacier.

Permeability, soil. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are: *Very slow*, *slow*, *moderately slow*, *moderate*, *moderately rapid*, *rapid*, and *very rapid*.

Physiographic province. One of the major geographic divisions of the continent.

Plastic limit. The moisture content at which a soil changes from a solid to a plastic state.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range in moisture content over which the soil remains plastic.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Quartzite. A compact granular metamorphosed sandstone.

Reaction, soil. The degree of acidity or alkalinity of the soil, expressed in pH values or in words, as follows:

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Residual soil. Soil formed in place by the disintegration and decomposition of rocks and the consequent weathering of the mineral materials. Presumably developed from the same kind of rock as that on which it lies.

Rill. A steep-sided channel resulting from accelerated erosion but usually only a few inches in depth and width; not large enough to be an obstacle to farm machinery.

Runoff. Surface drainage of rain or melted snow.

Sedimentary rock. Rock, such as sandstone, shale, and limestone, derived from the deposition of sediments.

Series, soil. A group of soils that have genetic horizons similar, except for the texture of the surface soil, as to differentiating characteristics and arrangement in the soil profile, and developed from a particular type of parent material. A series may include two or more soil types that differ from one another in the texture of the surface soil.

Shale. A sedimentary rock formed by the hardening of clay deposits.

Sheet erosion. The removal of a fairly uniform layer of soil or material from the land surface by the action of rainfall and runoff water.

Shrink-swell potential. Amount that a soil will expand or contract when wet or dry. Indicates kinds of clay in soil.

Soil association. A group of soils, with or without characteristics in common, that occur in a regular geographical pattern.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soils includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying parent material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Stripcropping. Growing crops in a systematic arrangement of strips or bands to serve as vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of the primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are platy, prismatic, columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are (1) single grain—each grain by itself, as in dune sand, or (2) massive—the particles adhering together without any regular cleavage as in many claypans and hardpans. ("Good" or "bad" tilth are terms for the general structural condition of cultivated soils according to particular plants or sequences of plants.)

Subsoil. Technically, the B horizon of soils with distinct profiles; roughly, that part of the profile below plow depth.

Substratum. Any layer lying beneath the solum, or true soil; the C or D horizon.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil; about 5 or 8 inches in thickness.

Syncline. Rock formations folded by lateral pressure into a trough; opposite of anticline.

Terrace. An embankment or ridge constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surplus runoff in order to retard it for infiltration into the soil and so that any excess may flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). An old alluvial plain, usually flat or undulating, bordering a stream; frequently called second bottom as contrasted with flood plain; seldom subject to overflow.

Texture, soil. The relative proportions of the various size groups of individual soil grains in a mass of soil. Specifically, it refers to the proportions of sand, silt, and clay. Some of the soil textural classes are:

Clay. As a soil textural class, soil material that contains 40 percent or more of clay, less than 45 percent sand, and less than 40 percent silt. As a soil separate, the mineral soil particles are less than 0.002 millimeter in diameter.

Loam. Soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand.

Sand. As a soil textural class, soil material that contains 85 percent or more sand and not more than 10 percent clay. As a soil separate, the individual rock or mineral fragments range from 0.05 millimeter to 2.0 millimeters in diameter.

Sandy loam. Soil material that contains either 20 percent clay or less, the percentage of silt plus twice the percentage of clay exceeds 30, and contains 52 percent or more sand; or less than 7 percent clay, less than 50 percent silt, and between 43 percent and 52 percent sand.

Silt. As a soil textural class, soil material that contains 80 percent or more of silt and less than 12 percent of clay. As a soil separate, the individual mineral soil particles range from 0.002 millimeter to 0.05 millimeter in diameter.

Silt loam. Soil material that contains 50 percent or more silt and 12 to 27 percent clay, or 50 to 80 percent silt and less than 12 percent clay.

Tilth, soil. The condition of the soil in its relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil (engineering term). Soil material containing organic matter and suitable as a surfacing for shoulders and slopes to promote the growth of vegetation.

Water-holding capacity. The ability of a soil to hold water that will not drain away but can be taken up by plant roots.

Water table. The upper limit of the part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

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GUIDE TO MAPPING UNITS, CAPABILITY UNITS, AND WOODLAND SUITABILITY GROUPS

Map symbol	*Soil*	*See page*	*Capability unit*	*See page*	*Woodland suitability group*	*See page*
AaA	Albrights channery loam, 0 to 3 percent slopes	47	IIw-2	8	3	18
AaB2	Albrights channery loam, 3 to 8 percent slopes, moderately eroded	47	IIe-4	7	3	18
AbA	Albrights silt loam, 0 to 3 percent slopes	47	IIw-2	8	3	18
AbB2	Albrights silt loam, 3 to 8 percent slopes, moderately eroded	47	IIe-4	7	3	18
AcB	Albrights very stony loam, 0 to 8 percent slopes	47	VIs-3	12	3	18
AcD	Albrights very stony loam, 8 to 25 percent slopes	47	VIs-3	12	3	18
AdA	Allenwood gravelly loam and silt loam, 0 to 3 percent slopes	48	I-2	7	1	17
AdB2	Allenwood gravelly loam and silt loam, 3 to 8 percent slopes, moderately eroded	48	IIe-1	7	1	17
AdC2	Allenwood gravelly loam and silt loam, 8 to 15 percent slopes, moderately eroded	48	IIIe-1	8	2	18
AgA	Allenwood gravelly silt loam, 0 to 3 percent slopes	49	I-2	7	1	17
AgB2	Allenwood gravelly silt loam, 3 to 8 percent slopes, moderately eroded	49	IIe-1	7	1	17
AgC2	Allenwood gravelly silt loam, 8 to 15 percent slopes, moderately eroded	49	IIIe-1	8	2	18
AgD2	Allenwood gravelly silt loam, 15 to 25 percent slopes, moderately eroded	49	IVe-1	10	2	18
AmC3	Allenwood gravelly silty clay loam, 8 to 15 percent slopes, severely eroded	49	IVe-1	10	2	18
AmD3	Allenwood gravelly silty clay loam, 15 to 25 percent slopes, severely eroded	49	VIe-1	11	2	18
AnB	Alvira gravelly silt loam, 0 to 8 percent slopes	50	IIIw-1	9	4	19
ArB	Alvira very stony silt loam, 0 to 8 percent slopes	50	VIs-4	12	4	19
AsA	Alvira and Shelmadine silt loams, 0 to 3 percent slopes	50	IIIw-1	9	4	19
AsB2	Alvira and Shelmadine silt loams, 3 to 8 percent slopes, moderately eroded	50	IIIw-1	9	4	19
AtB	Alvira and Shelmadine very stony silt loams, 0 to 8 percent slopes	51	VIs-4	12	4	19
AvA	Andover very stony loam, 0 to 3 percent slopes	51	VIIs-1	13	4	19
BcB2	Buchanan gravelly loam, 3 to 10 percent slopes, moderately eroded	52	IIe-4	7	3	18
BhB	Buchanan very stony loam, 0 to 8 percent slopes	52	VIs-3	12	3	18
BhD	Buchanan very stony loam, 8 to 25 percent slopes	52	VIs-3	12	3	18
CmA	Comly silt loam, 0 to 3 percent slopes	53	IIw-2	8	3	18
CmB2	Comly silt loam, 3 to 8 percent slopes, moderately eroded	53	IIe-4	7	3	18
CmC	Comly silt loam, 8 to 15 percent slopes	53	IIIe-5	9	3	18
CmC3	Comly silty clay loam, 8 to 15 percent slopes, severely eroded	53	IVe-4	10	3	18
CoB	Comly very stony silt loam, 0 to 8 percent slopes	53	VIs-3	12	3	18
CoD	Comly very stony silt loam, 8 to 25 percent slopes	53	VIs-3	12	3	18
CtA	Conotton gravelly loam, 0 to 3 percent slopes	54	IIs-1	8	1	17
CtB	Conotton gravelly loam, 3 to 8 percent slopes	54	IIe-1	7	1	17
CtD	Conotton gravelly loam, 15 to 25 percent slopes	54	IVe-1	10	2	18
DeB	Dekalb very stony loam, 0 to 8 percent slopes	55	VIs-2	12	6	19
DeD	Dekalb very stony loam, 8 to 25 percent slopes	55	VIs-2	12	7	19
DeF	Dekalb very stony loam, 25 to 100 percent slopes	55	VIIs-3	13	8	20
DrA	Drifton loam, 0 to 3 percent slopes	56	IIw-2	8	3	18
DrB2	Drifton loam, 3 to 8 percent slopes, moderately eroded	56	IIe-4	7	3	18
DsB	Drifton very stony loam, 0 to 8 percent slopes	56	VIs-3	12	3	18
FtA	Fleetwood sandy loam, 0 to 3 percent slopes	57	I-2	7	1	17
FtB2	Fleetwood sandy loam, 3 to 8 percent slopes, moderately eroded	57	IIe-1	7	1	17
FtC2	Fleetwood sandy loam, 8 to 15 percent slopes, moderately eroded	57	IIIe-1	8	2	18
FvB	Fleetwood very stony loam, shallow, 0 to 8 percent slopes	58	VIs-2	12	9	20
FvD	Fleetwood very stony loam, shallow, 8 to 25 percent slopes	58	VIs-2	12	10	20
FvF	Fleetwood very stony loam, shallow, 25 to 100 percent slopes	58	VIIs-3	13	11	20
FwB	Fleetwood very stony sandy loam, 0 to 8 percent slopes	58	VIs-1	11	1	17
FwD	Fleetwood very stony sandy loam, 8 to 25 percent slopes	58	VIs-1	11	2	18
HaA	Hartleton channery silt loam, 0 to 3 percent slopes	59	IIs-1	8	1	17
HaB2	Hartleton channery silt loam, 3 to 8 percent slopes, moderately eroded	59	IIe-3	7	1	17
HaC2	Hartleton channery silt loam, 8 to 15 percent slopes, moderately eroded	59	IIIe-3	9	2	18
HaC3	Hartleton channery silt loam, 8 to 15 percent slopes, severely eroded	59	IVe-2	10	2	18
HaD2	Hartleton channery silt loam, 15 to 25 percent slopes, moderately eroded	59	IVe-2	10	2	18
HaD3	Hartleton channery silt loam, 15 to 25 percent slopes, severely eroded	59	VIe-2	11	2	18
HsB	Hartleton very stony loam, 0 to 8 percent slopes	60	VIs-1	11	1	17
HsD	Hartleton very stony loam, 8 to 25 percent slopes	60	VIs-1	11	2	18
HtA	Hazleton loam, 0 to 3 percent slopes	60	I-2	7	1	17
HtB	Hazleton loam, 3 to 8 percent slopes	61	IIe-1	7	1	17
HtB2	Hazleton loam, 3 to 8 percent slopes, moderately eroded	61	IIe-1	7	1	17
HtC2	Hazleton loam, 8 to 15 percent slopes, moderately eroded	61	IIIe-1	8	2	18
HvB	Hazleton very stony loam, 0 to 8 percent slopes	61	VIs-1	11	1	17
HvD	Hazleton very stony loam, 8 to 25 percent slopes	61	VIs-1	11	2	18
Hy	Holly silt loam	62	VIw-1	11	5	19
KcB2	Klinesville channery silt loam, 3 to 8 percent slopes, moderately eroded	62	IIIe-4	9	9	20
KcC2	Klinesville channery silt loam, 8 to 15 percent slopes, moderately eroded	62	IVe-3	10	10	20
KcC3	Klinesville channery silt loam, 8 to 15 percent slopes, severely eroded	63	VIe-2	11	10	20
KcD2	Klinesville channery silt loam, 15 to 25 percent slopes, moderately eroded	63	VIe-2	11	10	20
KcD3	Klinesville channery silt loam, 15 to 25 percent slopes, severely eroded	63	VIIe-1	12	10	20
KcE2	Klinesville channery silt loam, 25 to 35 percent slopes, moderately eroded	63	VIIe-1	12	11	20
KcE3	Klinesville channery silt loam, 25 to 35 percent slopes, severely eroded	63	VIIe-1	12	11	20

GUIDE TO MAPPING UNITS, CAPABILITY UNITS, AND WOODLAND SUITABILITY GROUPS—Continued

Map symbol	Soil	See page	Capability unit	See page	Woodland suitability group	See page
KcF	Klinesville channery silt loam, 35 to 80 percent slopes	63	VIIe-1	12	11	20
KcF3	Klinesville channery silt loam, 35 to 80 percent slopes, severely eroded	63	VIIe-1	12	11	20
KvD	Klinesville very stony silt loam, 8 to 25 percent slopes	63	VIs-2	12	10	20
KvF	Klinesville very stony silt loam, 25 to 80 percent slopes	63	VIIs-3	13	11	20
LaB2	Laidig gravelly loam, 3 to 8 percent slopes, moderately eroded	64	IIe-2	7	1	17
LaC2	Laidig gravelly loam, 8 to 15 percent slopes, moderately eroded	64	IIIe-2	9	2	18
LaD3	Laidig gravelly loam, 15 to 25 percent slopes, severely eroded	65	VIe-1	11	2	18
LdB	Laidig very stony loam, 3 to 8 percent slopes	65	VIs-1	11	1	17
LdD	Laidig very stony loam, 8 to 25 percent slopes	65	VIs-1	11	2	18
LeA	Leck Kill channery silt loam, 0 to 3 percent slopes	65	IIs-1	8	6	19
LeB2	Leck Kill channery silt loam, 3 to 8 percent slopes, moderately eroded	65	IIe-3	7	6	19
LeC2	Leck Kill channery silt loam, 8 to 15 percent slopes, moderately eroded	66	IIIe-3	9	7	19
LeC3	Leck Kill channery silt loam, 8 to 15 percent slopes, severely eroded	66	IVe-2	10	7	19
LeD2	Leck Kill channery silt loam, 15 to 25 percent slopes, moderately eroded	66	IVe-2	10	7	19
LeD3	Leck Kill channery silt loam, 15 to 25 percent slopes, severely eroded	66	VIe-2	11	7	19
LkB	Leck Kill very stony loam, 0 to 8 percent slopes	66	VIs-2	12	6	19
LkD	Leck Kill very stony loam, 8 to 25 percent slopes	66	VIs-2	12	7	19
LkF	Leck Kill very stony loam, 25 to 100 percent slopes	67	VIIs-3	13	8	20
LsA	Lickdale and Tughill loams and silt loams, 0 to 3 percent slopes	67	Vw-1	11	5	19
LtA	Lickdale and Tughill very stony loams, 0 to 8 percent slopes	67	VIIs-2	13	5	19
LvB	Lordstown very stony silt loam, 0 to 8 percent slopes	68	VIs-2	12	6	19
LvD	Lordstown very stony silt loam, 8 to 25 percent slopes	68	VIs-2	12	7	19
LvF	Lordstown very stony silt loam, 25 to 80 percent slopes	68	VIIs-3	13	8	20
Ma	Madel and	68	VIIIs-1	13	12	20
MbA	Meckesville channery loam, 0 to 3 percent slopes	69	I-2	7	1	17
MbB2	Meckesville channery loam, 3 to 8 percent slopes, moderately eroded	69	IIe-1	7	1	17
MbC2	Meckesville channery loam, 8 to 15 percent slopes, moderately eroded	69	IIIe-1	8	2	18
McB	Meckesville very stony loam, 0 to 8 percent slopes	69	VIs-1	11	1	17
McD	Meckesville very stony loam, 8 to 25 percent slopes	69	VIs-1	11	2	18
MdA	Middlebury silt loam, 0 to 3 percent slopes	70	IIw-1	8	3	18
MdB	Middlebury silt loam, 3 to 8 percent slopes	70	IIw-1	8	3	18
MeA3	Middlebury and Tioga silt loams, 0 to 3 percent slopes, severely eroded	70	IVe-4	10	3	18
Mm	Mine dumps	70	VIIIs-1	13	12	20
Mn	Mine dumps, coal	70	VIIIs-1	13	12	20
MoA	Montevallo channery silt loam, 0 to 3 percent slopes	71	IIIe-4	9	9	20
MoB2	Montevallo channery silt loam, 3 to 8 percent slopes, moderately eroded	71	IIIe-4	9	9	20
MoB3	Montevallo channery silt loam, 3 to 8 percent slopes, severely eroded	71	IVe-3	10	9	20
MoC2	Montevallo channery silt loam, 8 to 15 percent slopes, moderately eroded	71	IVe-3	10	10	20
MoC3	Montevallo channery silt loam, 8 to 15 percent slopes, severely eroded	72	VIe-2	11	10	20
MoD2	Montevallo channery silt loam, 15 to 25 percent slopes, moderately eroded	72	VIe-2	11	10	20
MoD3	Montevallo channery silt loam, 15 to 25 percent slopes, severely eroded	72	VIIe-1	12	10	20
MoE2	Montevallo channery silt loam, 25 to 35 percent slopes, moderately eroded	72	VIIe-1	12	11	20
MoE3	Montevallo channery silt loam, 25 to 35 percent slopes, severely eroded	72	VIIe-1	12	11	20
MoF2	Montevallo channery silt loam, 35 to 100 percent slopes, eroded	72	VIIe-1	12	11	20
MrB	Morris very stony silt loam, 0 to 8 percent slopes	73	VIIs-1	13	4	19
Mu	Muck and Peat	73	VIIw-1	13	13	20
NaB	Natalie very stony loam, 0 to 8 percent slopes	74	VIs-3	12	4	19
NoA	Norwich silt loam, 0 to 3 percent slopes	74	Vw-1	11	5	19
NoB	Norwich silt loam, 3 to 8 percent slopes	74	Vw-1	11	5	19
NvB	Norwich very stony loam, 0 to 8 percent slopes	75	VIIs-2	13	5	19
Pa	Papakating silty clay loam	75	VIw-1	11	13	20
PkA	Pekin silt loam, 0 to 3 percent slopes	76	IIw-2	8	3	18
Ra	Riverwash	76	VIIIs-1	13	12	20
Rc	Riverwash, coal	76	VIIIs-1	13	12	20
RsB	Rushtown shaly silt loam, 3 to 8 percent slopes	76	IIIe-4	9	9	20
RsC	Rushtown shaly silt loam, 8 to 15 percent slopes	76	IVe-3	10	10	20
RsD	Rushtown shaly silt loam, 15 to 25 percent slopes	77	VIe-2	11	10	20
RsE	Rushtown shaly silt loam, 25 to 35 percent slopes	77	VIIe-1	12	11	20
ShA	Shelmadine silt loam, 0 to 3 percent slopes	77	IVw-1	10	4	19
ShB2	Shelmadine silt loam, 3 to 8 percent slopes, moderately eroded	77	IVwfIII	10	4	19
SmB	Shelmadine very stony silt loam, 0 to 8 percent slopes	78	VIIs-1	13	4	19
Sr	Strip mines	78	VIIIs-1	13	12	20
SsB	Swartswood channery silt loam, 0 to 8 percent slopes	78	IIe-2	7	1	17
SsC2	Swartswood channery silt loam, 8 to 15 percent slopes, moderately eroded	79	IIIe-2	9	2	18
SwB	Swartswood very stony loam, 0 to 8 percent slopes	79	VIs-1	11	1	17
SwD	Swartswood very stony loam, 8 to 25 percent slopes	79	VIs-1	11	2	18
Tf	Tioga fine sandy loam	79	I-1	6	1	17
Tg	Tioga silt loam	79	I-1	6	1	17
TmB	Tioga and Middlebury very stony loams, 0 to 8 percent slopes	80	VIIs-1	13	3	18
TuA	Tunkhannock gravelly loam, 0 to 3 percent slopes	81	I-2	7	1	17
TuB	Tunkhannock gravelly loam, 3 to 8 percent slopes	81	IIe-1	7	1	17
TuC	Tunkhannock gravelly loam, 8 to 15 percent slopes	81	IIIe-1	8	2	18
TuD	Tunkhannock gravelly loam, 15 to 25 percent slopes	81	IVe-1	10	2	18
VeB	Very stony land, 0 to 8 percent slopes	81	VIIIs-1	13	12	20
VeD	Very stony land, 8 to 25 percent slopes	81	VIIIs-1	13	12	20

GUIDE TO MAPPING UNITS, CAPABILITY UNITS, AND WOODLAND SUITABILITY GROUPS—Continued

Map symbol	*Soil*	*See page*	*Capability unit*	*See page*	*Woodland suitability group*	*See page*
VeF	Very stony land, 25 to 120 percent slopes	82	VIIIs-1	13	12	20
VoB	Volusia silt loam, 0 to 8 percent slopes	82	IIIw-1	9	4	19
VsB	Volusia very stony loam, 0 to 8 percent slopes	82	VIs-4	12	4	19
WaB2	Watson gravelly silt loam, 0 to 8 percent slopes, moderately eroded	83	IIe-4	7	3	18
WsA	Watson silt loam, 0 to 3 percent slopes	83	IIw-2	8	3	18
WsB2	Watson silt loam, 3 to 8 percent slopes, moderately eroded	84	IIe-4	7	3	18
WsC2	Watson silt loam, 8 to 15 percent slopes, moderately eroded	84	IIIe-5	9	3	18
WtC3	Watson silty clay loam, 8 to 15 percent slopes, severely eroded	84	IVe-4	10	3	18
WuA	Wurtsboro channery loam, 0 to 3 percent slopes	85	IIw-2	8	3	18
WuB2	Wurtsboro channery loam, 3 to 8 percent slopes, moderately eroded	85	IIe-4	7	3	18
WvB	Wurtsboro very stony loam, 0 to 8 percent slopes	85	VIs-3	12	3	18
WvD	Wurtsboro very stony loam, 8 to 25 percent slopes	85	VIs-3	12	3	18

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SOIL ASSOCIATIONS

1 — Shallow to deep soils on gray glacial till: Lordstown-Swartswood association

2 — Moderately deep and deep soils on reddish-brown glacial till: Meckesville-Albrights association

3 — Deep and moderately deep soils on gray glacial till and some shallow soils on sandstone: Hazleton-Drifton association

4 — Shallow to deep soils on glaciated, coarse sandstone and conglomerate: Fleetwood-Natalie association

5 — Soils on colluvium along the bases of steep mountains: Laidig-Buchanan association

6 — Shallow to deep soils on glaciated, gray siltstone, shale, and fine sandstone: Montevallo-Hartleton association

7 — Deep soils from glacial till of varying age and mixture: Hartleton-Allenwood association

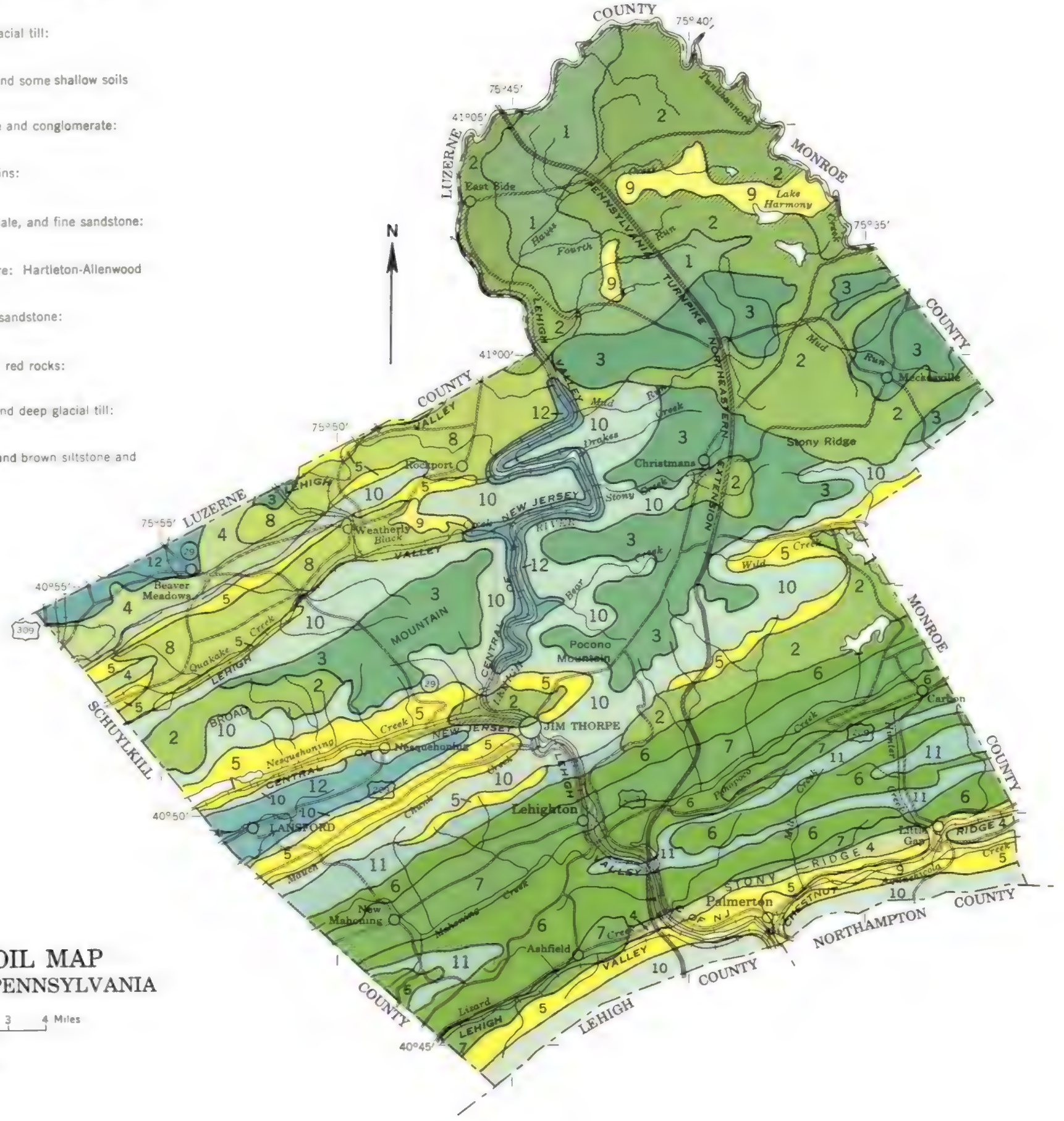
8 — Soils on shallow to deep, reddish siltstone and fine sandstone: Allenwood-Watson-Klinesville association

9 — Deep soils on glacial outwash derived from gray and red rocks: Tunkhannock-Conotton association

10 — Steep, stony soils on frost-worked, gray sandstone and deep glacial till: Dekalb-Hazleton steep soils association

11 — Shallow to moderately deep soils on glaciated, red and brown siltstone and shale: Klinesville-Leck Kill association

12 — Miscellaneous land types association



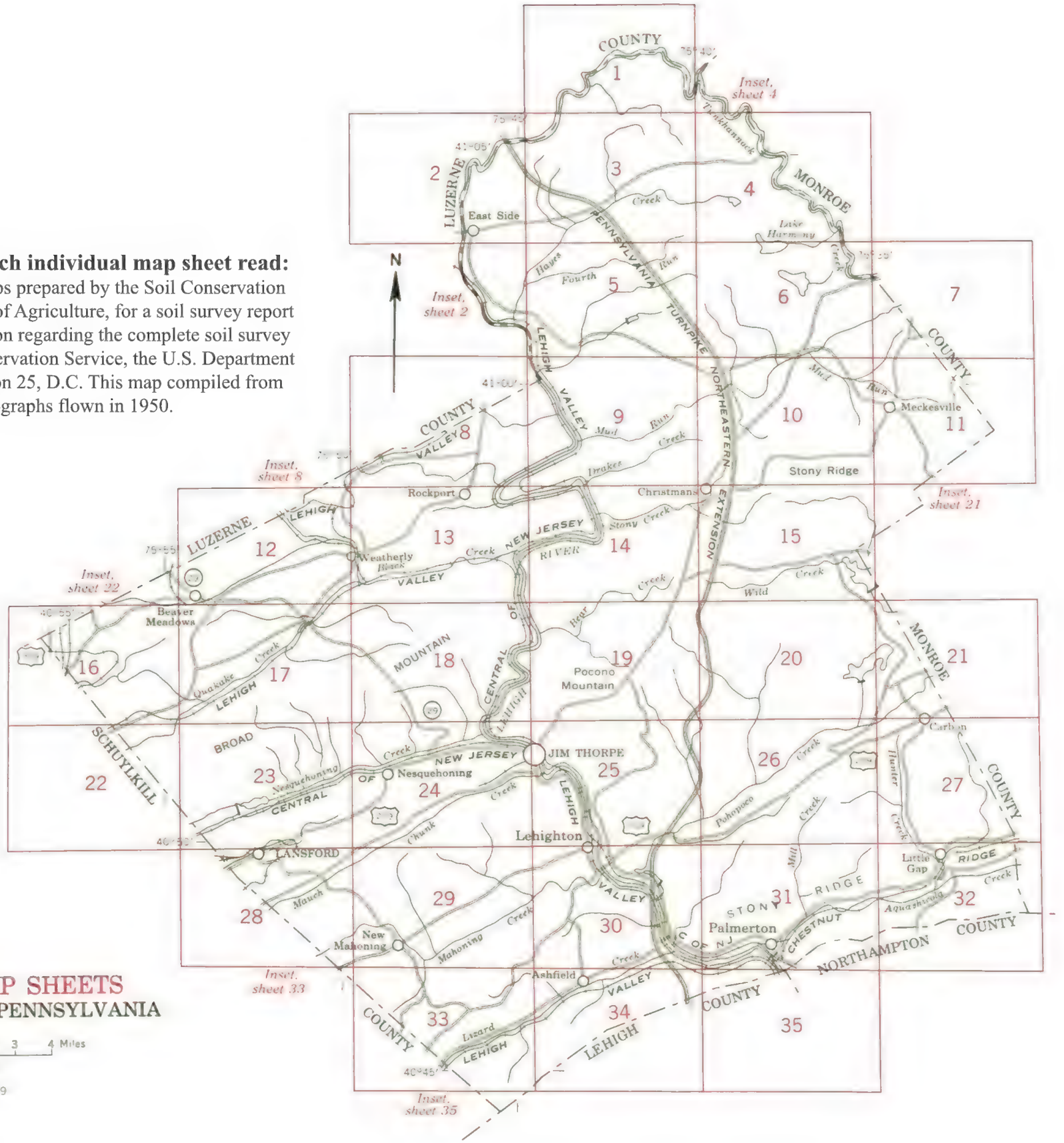
GENERAL SOIL MAP
CARBON COUNTY, PENNSYLVANIA

0 1 2 3 4 Miles

Scale

1:188,179

Original text from each individual map sheet read:
This is one of a set of maps prepared by the Soil Conservation Service, U.S. Department of Agriculture, for a soil survey report of this area. For information regarding the complete soil survey report, write the Soil Conservation Service, the U.S. Department of Agriculture, Washington 25, D.C. This map compiled from aerial photographs flown in 1950.



U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

CARBON COUNTY, PENNSYLVANIA

PENNSYLVANIA STATE UNIVERSITY
COLLEGE OF AGRICULTURE AND EXPERIMENT STATION
PENNSYLVANIA DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION COMMISSION

SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, D, E, or F, shows the steepness of slope. Symbols without a slope letter are those of nearly level soils, such as Holly silt loam, or of land types that have a range of slope, such as Strip mines.

SYMBOL	NAME
AaA	Albrights channery loam, 0 to 3 percent slopes
AaB2	Albrights channery loam, 3 to 8 percent slopes, moderately eroded
AbA	Albrights silt loam, 0 to 3 percent slopes
AbB2	Albrights silt loam, 3 to 8 percent slopes, moderately eroded
AvB	Albrights very stony loam, 0 to 8 percent slopes
AvC	Albrights very stony loam, 8 to 25 percent slopes
AgA	Allenwood gravelly loam and silt loam, 0 to 3 percent slopes
AgB2	Allenwood gravelly loam and silt loam, 3 to 8 percent slopes, moderately eroded
AgC2	Allenwood gravelly loam and silt loam, 8 to 15 percent slopes, moderately eroded
AgA	Allenwood gravelly silt loam, 0 to 3 percent slopes
AgB2	Allenwood gravelly silt loam, 3 to 8 percent slopes, moderately eroded
AgC2	Allenwood gravelly silt loam, 8 to 15 percent slopes, moderately eroded
AgD2	Allenwood gravelly silt loam, 15 to 25 percent slopes, moderately eroded
AmC3	Allenwood gravelly silty clay loam, 8 to 15 percent slopes, severely eroded
AmD3	Allenwood gravelly silty clay loam, 15 to 25 percent slopes, severely eroded
ArB	Alvira gravelly silt loam, 0 to 8 percent slopes
AvB	Alvira very stony silt loam, 0 to 8 percent slopes
AsA	Alvira and Shelmadine silt loams, 0 to 3 percent slopes
AsB2	Alvira and Shelmadine silt loams, 3 to 8 percent slopes, moderately eroded
AtB	Alvira and Shelmadine very stony silt loams, 0 to 8 percent slopes
AvA	Andover very stony loam, 0 to 3 percent slopes
BrB2	Buchanan gravelly loam, 3 to 10 percent slopes, moderately eroded
BnB	Buchanan very stony loam, 0 to 8 percent slopes
BnD	Buchanan very stony loam, 8 to 25 percent slopes
CmA	Comly silt loam, 0 to 3 percent slopes
CmB2	Comly silt loam, 3 to 8 percent slopes, moderately eroded
CmC	Comly silt loam, 8 to 15 percent slopes
CmC3	Comly silty clay loam, 8 to 15 percent slopes, severely eroded
CsB	Comly very stony silt loam, 0 to 8 percent slopes
CsD	Comly very stony silt loam, 8 to 25 percent slopes
CtA	Conotton gravelly loam, 0 to 3 percent slopes
CtB	Conotton gravelly loam, 3 to 8 percent slopes
CtD	Conotton gravelly loam, 15 to 25 percent slopes
DeB	Dekalb very stony loam, 0 to 8 percent slopes
DeC	Dekalb very stony loam, 8 to 25 percent slopes
DeF	Dekalb very stony loam, 25 to 100 percent slopes
DrA	Drifton loam, 0 to 3 percent slopes
DrB2	Drifton loam, 3 to 8 percent slopes, moderately eroded
DsB	Drifton very stony loam, 0 to 8 percent slopes
FtA	Fleetwood sandy loam, 0 to 3 percent slopes
FtB2	Fleetwood sandy loam, 3 to 8 percent slopes, moderately eroded
FtC2	Fleetwood sandy loam, 8 to 15 percent slopes, moderately eroded
FwB	Fleetwood very stony loam, shallow, 0 to 8 percent slopes
FwD	Fleetwood very stony loam, shallow, 8 to 25 percent slopes
FwF	Fleetwood very stony loam, shallow, 25 to 100 percent slopes
FwB	Fleetwood very stony sandy loam, 0 to 8 percent slopes
FwD	Fleetwood very stony sandy loam, 8 to 25 percent slopes
HaA	Hartleton channery silt loam, 0 to 3 percent slopes
HaB2	Hartleton channery silt loam, 3 to 8 percent slopes, moderately eroded
HaC2	Hartleton channery silt loam, 8 to 15 percent slopes, moderately eroded
HaC3	Hartleton channery silt loam, 8 to 15 percent slopes, severely eroded
HaD2	Hartleton channery silt loam, 15 to 25 percent slopes, moderately eroded
HaD3	Hartleton channery silt loam, 15 to 25 percent slopes, severely eroded
HsB	Hartleton very stony loam, 0 to 8 percent slopes
HsD	Hartleton very stony loam, 8 to 25 percent slopes
HtA	Hazleton loam, 0 to 3 percent slopes
HtB	Hazleton loam, 3 to 8 percent slopes
HtB2	Hazleton loam, 3 to 8 percent slopes, moderately eroded
HtC2	Hazleton loam, 8 to 15 percent slopes, moderately eroded
HvB	Hazleton very stony loam, 0 to 8 percent slopes
HvD	Hazleton very stony loam, 8 to 25 percent slopes
Hy	Holly silt loam
KcB2	Klinesville channery silt loam, 3 to 8 percent slopes, moderately eroded
KcC2	Klinesville channery silt loam, 8 to 15 percent slopes, moderately eroded
KcC3	Klinesville channery silt loam, 8 to 15 percent slopes, severely eroded
KcD2	Klinesville channery silt loam, 15 to 25 percent slopes, moderately eroded
KcD3	Klinesville channery silt loam, 15 to 25 percent slopes, severely eroded
KcE2	Klinesville channery silt loam, 25 to 35 percent slopes, moderately eroded
KcE3	Klinesville channery silt loam, 25 to 35 percent slopes, severely eroded
KcF	Klinesville channery silt loam, 35 to 80 percent slopes
KcF3	Klinesville channery silt loam, 35 to 80 percent slopes, severely eroded
KvD	Klinesville very stony silt loam, 8 to 25 percent slopes
KvF	Klinesville very stony silt loam, 25 to 80 percent slopes
LaB2	Laidig gravelly loam, 3 to 8 percent slopes, moderately eroded
LaC2	Laidig gravelly loam, 8 to 15 percent slopes, moderately eroded
LaD3	Laidig gravelly loam, 15 to 25 percent slopes, severely eroded
LdB	Laidig very stony loam, 3 to 8 percent slopes
LdD	Laidig very stony loam, 8 to 25 percent slopes
LeA	Leck Kill channery silt loam, 0 to 3 percent slopes
LeB2	Leck Kill channery silt loam, 3 to 8 percent slopes, moderately eroded
LeC2	Leck Kill channery silt loam, 8 to 15 percent slopes, moderately eroded
LeC3	Leck Kill channery silt loam, 8 to 15 percent slopes, severely eroded
LeD2	Leck Kill channery silt loam, 15 to 25 percent slopes, moderately eroded
LeD3	Leck Kill channery silt loam, 15 to 25 percent slopes, severely eroded
LkB	Leck Kill very stony loam, 0 to 8 percent slopes
LkD	Leck Kill very stony loam, 8 to 25 percent slopes
LkF	Leck Kill very stony loam, 25 to 100 percent slopes
LsA	Lickdale and Tughill loams and silt loams, 0 to 3 percent slopes
LtA	Lickdale and Tughill very stony loams, 0 to 8 percent slopes
LvB	Lordstown very stony silt loam, 0 to 8 percent slopes
LvD	Lordstown very stony silt loam, 8 to 25 percent slopes
LvF	Lordstown very stony silt loam, 25 to 80 percent slopes
Ma	Made land
MbA	Meckesville channery loam, 0 to 3 percent slopes
MbB2	Meckesville channery loam, 3 to 8 percent slopes, moderately eroded
MbC2	Meckesville channery loam, 8 to 15 percent slopes, moderately eroded
McB	Meckesville very stony loam, 0 to 8 percent slopes
McD	Meckesville very stony loam, 8 to 25 percent slopes
MdA	Middlebury silt loam, 0 to 3 percent slopes
MdB	Middlebury silt loam, 3 to 8 percent slopes
MeA3	Middlebury and Tioga silt loams, 0 to 3 percent slopes, severely eroded
Mm	Mine dumps
Mn	Mine dumps, coal
MoA	Montevallo channery silt loam, 0 to 3 percent slopes
MoB2	Montevallo channery silt loam, 3 to 8 percent slopes, moderately eroded
MoB3	Montevallo channery silt loam, 3 to 8 percent slopes, severely eroded
MoC2	Montevallo channery silt loam, 8 to 15 percent slopes, moderately eroded
MoC3	Montevallo channery silt loam, 8 to 15 percent slopes, severely eroded
MoD2	Montevallo channery silt loam, 15 to 25 percent slopes, moderately eroded
MoD3	Montevallo channery silt loam, 15 to 25 percent slopes, severely eroded
MoE2	Montevallo channery silt loam, 25 to 35 percent slopes, moderately eroded
MoE3	Montevallo channery silt loam, 25 to 35 percent slopes, severely eroded
MoF2	Montevallo channery silt loam, 35 to 100 percent slopes, eroded
MrB	Morris very stony silt loam, 0 to 8 percent slopes
Mu	Muck and Peat
NaB	Natalie very stony loam, 0 to 8 percent slopes
NoA	Norwich silt loam, 0 to 3 percent slopes
NoB	Norwich silt loam, 3 to 8 percent slopes
NvB	Norwich very stony loam, 0 to 8 percent slopes
Pa	Papakating silty clay loam
PkA	Pekin silt loam, 0 to 3 percent slopes
Ra	Riverwash
Rc	Riverwash, coal
RsB	Rushtown shaly silt loam, 3 to 8 percent slopes
RsC	Rushtown shaly silt loam, 8 to 15 percent slopes
RsD	Rushtown shaly silt loam, 15 to 25 percent slopes
RsE	Rushtown shaly silt loam, 25 to 35 percent slopes
ShA	Shelmadine silt loam, 0 to 3 percent slopes
ShB2	Shelmadine silt loam, 3 to 8 percent slopes, moderately eroded
ShB	Shelmadine very stony silt loam, 0 to 8 percent slopes
Sr	Strip mines
SsB	Swartswood channery silt loam, 0 to 8 percent slopes
SsC2	Swartswood channery silt loam, 8 to 15 percent slopes, moderately eroded
SwB	Swartswood very stony loam, 0 to 8 percent slopes
SwD	Swartswood very stony loam, 8 to 25 percent slopes
Tf	Tioga fine sandy loam
Tg	Tioga silt loam
TmB	Tioga and Middlebury very stony loams, 0 to 8 percent slopes
TuA	Tunkhannock gravelly loam, 0 to 3 percent slopes
TuB	Tunkhannock gravelly loam, 3 to 8 percent slopes
TuC	Tunkhannock gravelly loam, 8 to 15 percent slopes
TuD	Tunkhannock gravelly loam, 15 to 25 percent slopes
VeB	Very stony land, 0 to 8 percent slopes
VeD	Very stony land, 8 to 25 percent slopes
VeF	Very stony land, 25 to 120 percent slopes
VoB	Volusia silt loam, 0 to 8 percent slopes
VsB	Volusia very stony loam, 0 to 8 percent slopes
WaB2	Watson gravelly silt loam, 0 to 8 percent slopes, moderately eroded
WsA	Watson silt loam, 0 to 3 percent slopes
WsB2	Watson silt loam, 3 to 8 percent slopes, moderately eroded
WsC2	Watson silt loam, 8 to 15 percent slopes, moderately eroded
WtC3	Watson silty clay loam, 8 to 15 percent slopes, severely eroded
WuA	Wurtsboro channery loam, 0 to 3 percent slopes
WuB2	Wurtsboro channery loam, 3 to 8 percent slopes, moderately eroded
WvB	Wurtsboro very stony loam, 0 to 8 percent slopes
WvD	Wurtsboro very stony loam, 8 to 25 percent slopes

Soil map constructed 1961 by Cartographic Division, Soil Conservation Service, USDA, from 1950 aerial photographs. Controlled mosaic based on Pennsylvania plane coordinate system, north zone, Lambert conformal conic projection, 1927 North American datum.

CARBON COUNTY, PENNSYLVANIA

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads

- Dual
- Good motor
- Poor motor
- Trail

Highway markers

- National Interstate
- U. S.
- State

Railroads

- Single track
- Multiple track
- Abandoned

Bridges and crossings

- Road
- Trail, foot
- Railroad
- Ferries
- Ford
- Grade
- R. R. over
- R. R. under
- Tunnel

Buildings

- School
- Church
- Station

Mines and Quarries

Mine dump

Pits, gravel or other

Power lines

Pipe lines

Cemeteries

Dams

Levees

Tanks

Forest fire or lookout station

BOUNDARIES

- National or state
- County
- Township, U. S.
- Section line, corner
- Reservation
- Land grant
- Township, civil

DRAINAGE

Streams

- Perennial
- Intermittent, unclass.

Canals and ditches

Lakes and ponds

- Perennial
- Intermittent

Wells

Springs

Marsh

Wet spot

RELIEF

Escarpments

- Bedrock
- Other

Prominent peaks

Depressions

	Large	Small
Crossable with tillage implements		
Not crossable with tillage implements		
Contains water most of the time		

SOIL SURVEY DATA

Soil boundary and symbol

- Inundated soil area boundary
- Gravel
- Stones, very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gullies

N

LUZERNE COUNTY

RIVER

LEHIGH

K I D D E R

BEAR CREEK DAM

Cutler

Lime

Porter

Run

(Joins inset, sheet 4)

(Joins sheet 3)

0 1 Mile

Scale 1: 20 000

0 5000 Feet

CARBON COUNTY, PENNSYLVANIA-SHEET NUMBER 2

N

(Joins lower right)

(Joins sheet 5)

(Joins sheet 3)

(Joins upper left)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

(Joins sheet 1)

3

N

(Joins sheet 2)

(Joins sheet 4)

(Joins sheet 5)

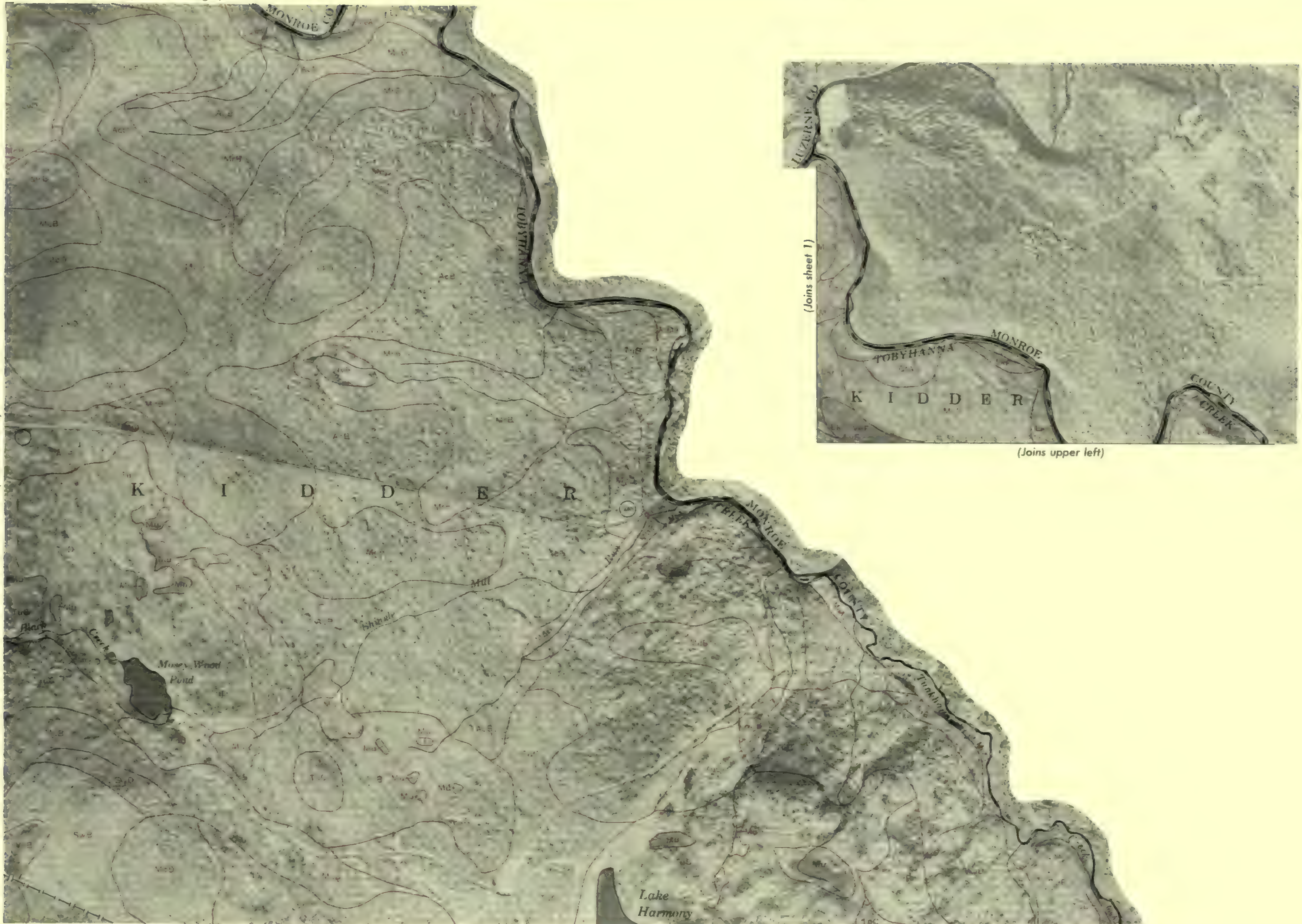
0 1 Mile Scale 1: 20 000 0 5000 Feet

4

N

(Joins lower right)

(Joins sheet 3)



(Joins sheet 6)

(Joins sheet 1)

(Joins upper left)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

(Joins sheet 3)

5

N

(Joins inset, sheet 2)

(Joins sheet 6)

(Joins sheet 9)

0 1 Mile Scale 1:20 000 0 5000 Feet

(6)

(Joins sheet 4)

N

APPROXIMATE BOUNDARY

Split Rock

Lake Harmony

Lake Harmony

Big Boulder Field

Hickory Run

Grass Lake

Round Pond

MONROE COUNTY

L a k e

M o u n t a i n

HICKORY RUN

STATE PARK

K I D D E R

Albrightsville

PENN FOREST

(Joins sheet 5)

(Joins sheet 7)

(Joins sheet 10)

Scale 1: 20 000

N

(Joins sheet 6)

KIDDER

PENN FOREST

Dilldown Creek

MONROE COUNTY

(Joins sheet 11)

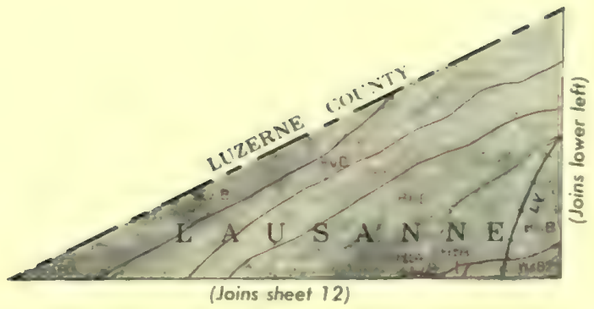
0 ½ 1 Mile

Scale 1 20 000

0 5000 Feet

(8)

N



(Joins sheet 12)

(Joins lower left)

(Joins sheet 9)

(Joins upper right)

(Joins sheet 13)

Scale 1:20 000

1 Mile

0 5000 Feet

(Joins sheet 5)

9

N

HICKORY RUN STATE PARK

HICKORY RUN STATE PARK

KIDDER MOUNTAIN

SUMMER MOUNTAIN

PENN FOREST

LEHIGH

Hickory Run

Hickory Run Station

Leslie Run

Mud Run

Drakes Creek

Christmanville

LUZERNE COUNTY

LEHIGH VALLEY

CENTRAL OF NEW JERSEY RR

LEHIGH RIVER

APPROXIMATE BOUNDARY

APPROXIMATE BOUNDARY

LEHIGH VALLEY

(Joins sheet 8)

(Joins sheet 10)

(Joins sheet 14)

0 ½ 1 Mile Scale 1 20,000 0 5000 Feet

10

(Joins sheet 6)

N

(Joins sheet 9)

(Joins sheet 11)

(Joins sheet 15)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

(Joins sheet 7)

(Joins sheet 10)

(Joins inset, sheet 21)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

(Joins inset, sheet 8)

N

(Joins sheet 13)

(Joins inset, sheet 22)

(Joins sheet 17)

0 ½ 1 Mile

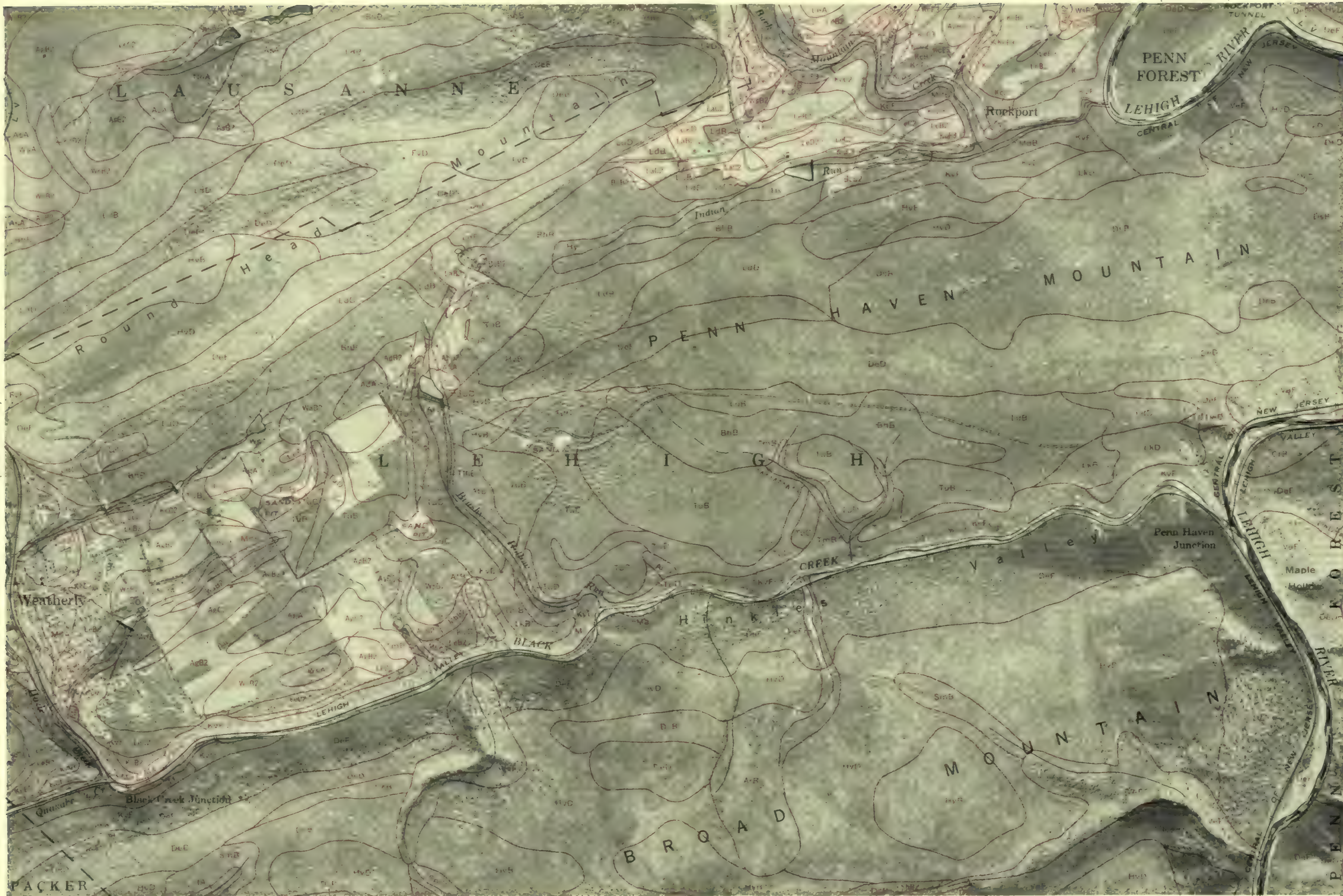
Scale 1: 20 000

0 5000 Feet

(13)

(Joins sheet 8)

(Joins sheet 12)



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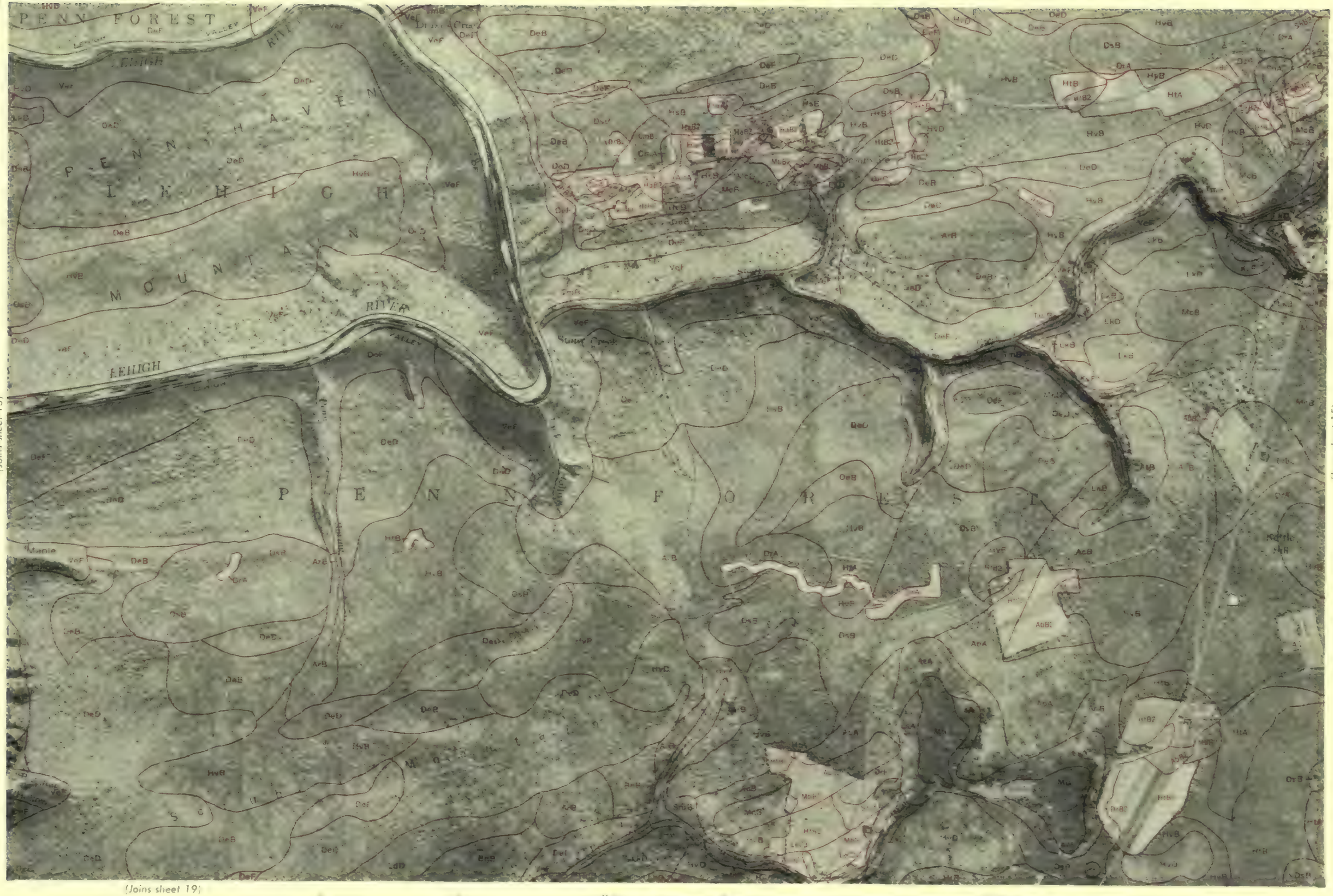
(Joins sheet 18)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

(14)



(Joins sheet 13)

(Joins sheet 15)

(Joins sheet 19)

(Joins sheet 10)

(Joins sheet 14)

(Joins inset, sheet 21)

(Joins inset, sheet 21)

Scale 1:20 000

0 ½ 1 Mile

0 5000 Feet

(Joins sheet 20)

16

N

(Joins inset, sheet 22)

Junedale (Lewiston)

LUZERNE COUNTY

LEHIGH VALLEY

B A N K S

M O U N T A I N

Audenried

Freeckow

NEW JERSEY CENTRAL

S P R I N G

SCHUYLKILL COUNTY

P A C K E R

GREEN ACRES AIRPORT

Stewarts

LEHIGH VALLEY

(Joins sheet 17)

(Joins sheet 22)

0 ½ 1 Mile Scale 1 20 000 0 5000 Feet

(Joins sheet 12)

17

N

B A N K S

M O U N T A I N

S P R I N G

Weitzel Creek

Hudsondale

Oberson

P A C K E R

M O U N T A I N

GREEN ACRES AIRPORT

Gerhards

Orchard

B R O A D

M A U C H C H U N K

(Joins sheet 16)

(Joins sheet 18)

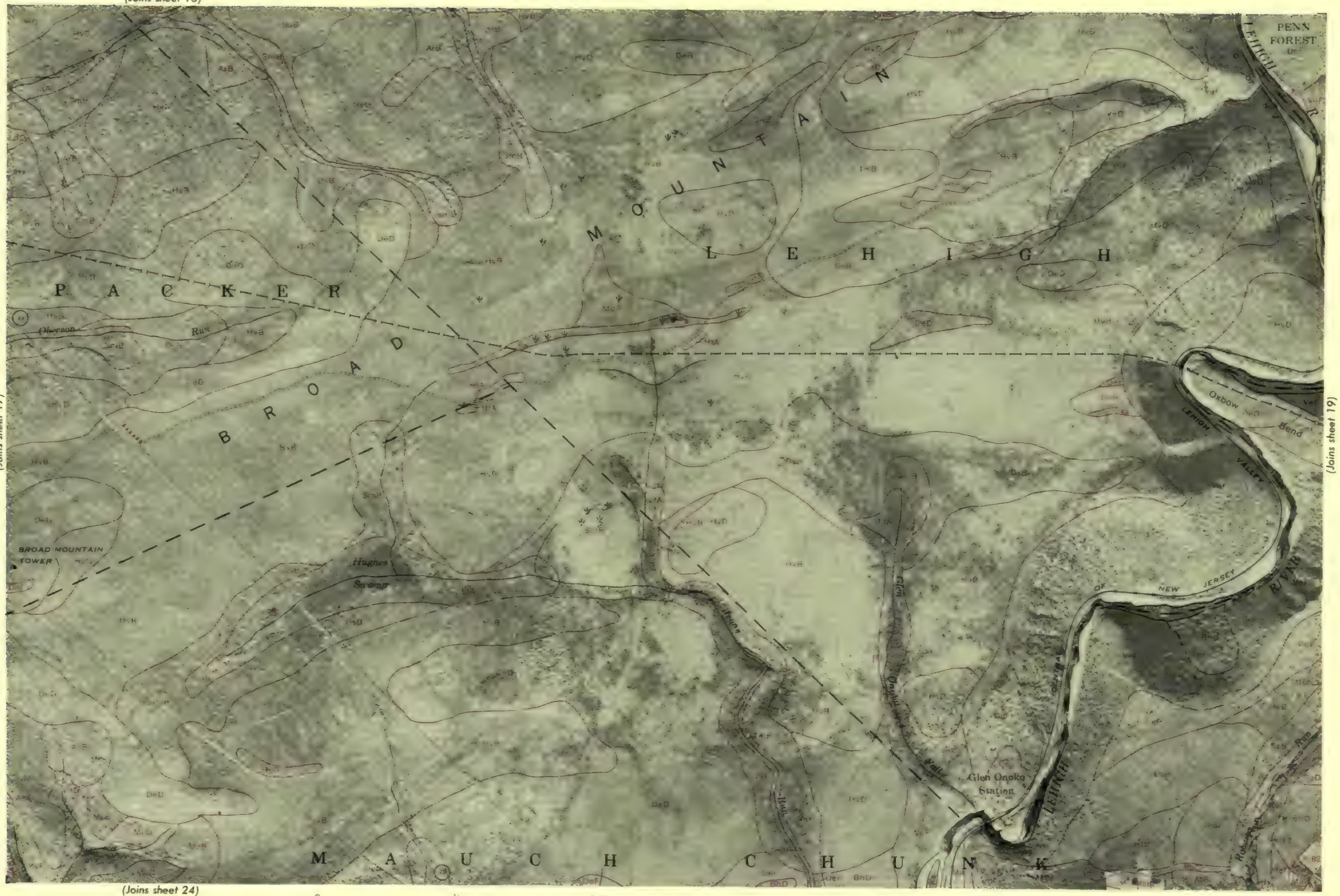
(Joins sheet 23)

0 1 Mile Scale 1:20 000 0 5000 Feet

(18)

(Joins sheet 13)

N



(Joins sheet 17)

(Joins sheet 19)

(Joins sheet 24)

0 ½ 1 Mile

Scale 1: 20 000

0 5000 Feet

(Joins sheet 14)

19

N

(Joins sheet 18)

(Joins sheet 20)

(Joins sheet 25)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

20

(Joins sheet 15)

N

(Joins sheet 19)

(Joins sheet 21)

(Joins sheet 26)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

(Joins lower right)

(Joins sheet 20)

(Joins sheet 27)

(Joins sheet 11)

(Joins sheet 15)

(Joins upper left)

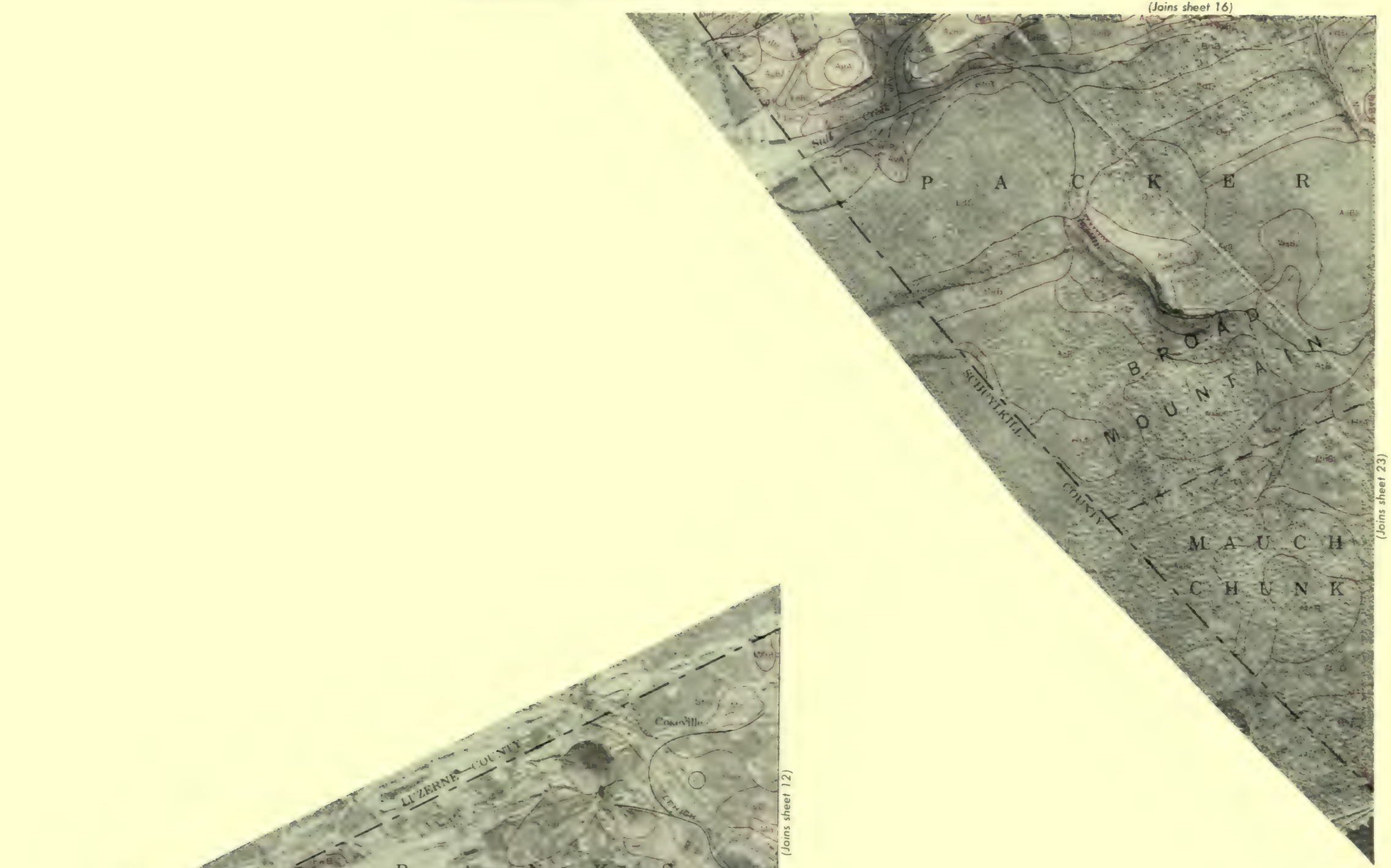
N

0 ½ 1 Mile

Scale 1: 20 000 0 5000 Feet

(22)

N



Scale 1:20,000

5000 Feet

(Joins sheet 17)

23

(Joins sheet 22)

(Joins sheet 24)

(Joins sheet 28)

(24)

(Joins sheet 18)

N

(Joins sheet 23)

(Joins sheet 25)

(Joins sheet 29)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

(Joins sheet 19)

25

N

(Joins sheet 24)

(Joins sheet 26)

0 ½ 1 Mile

Scale 1: 20 000

0 5000 Feet

(Joins sheet 30)

(26)

(Joins sheet 20)

N

(Joins sheet 25)

(Joins sheet 27)

Forest Inn

T O W A M E N S I N G

Stemlersville

F R A N K L I N

Bolivia

Ball

L O W E R

T O W A M E N S I N G

(Joins sheet 31)

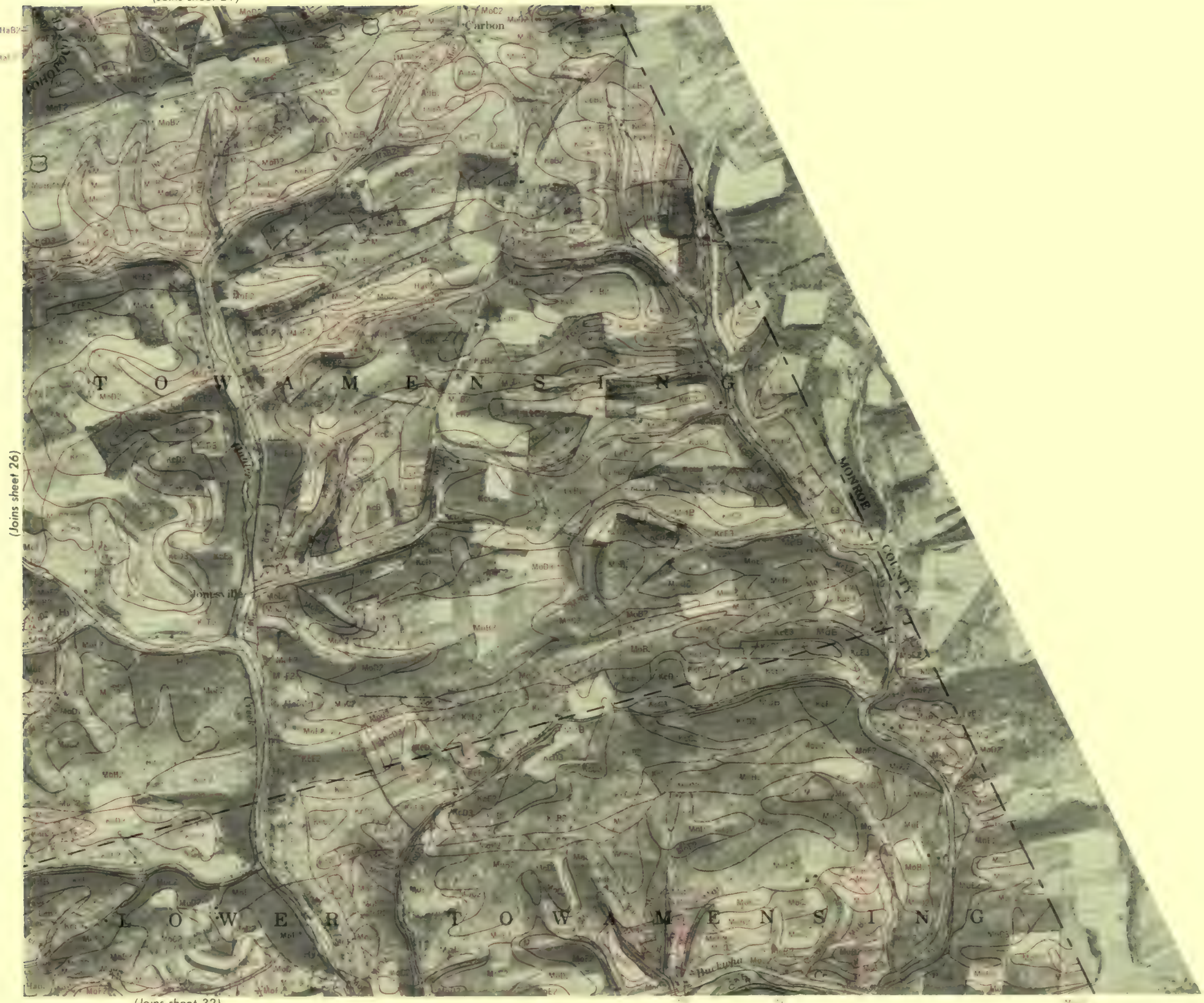
0 ½ 1 Mile

Scale 1 20 000

0 5000 Feet

(Joins sheet 21)

(Joins sheet 26)



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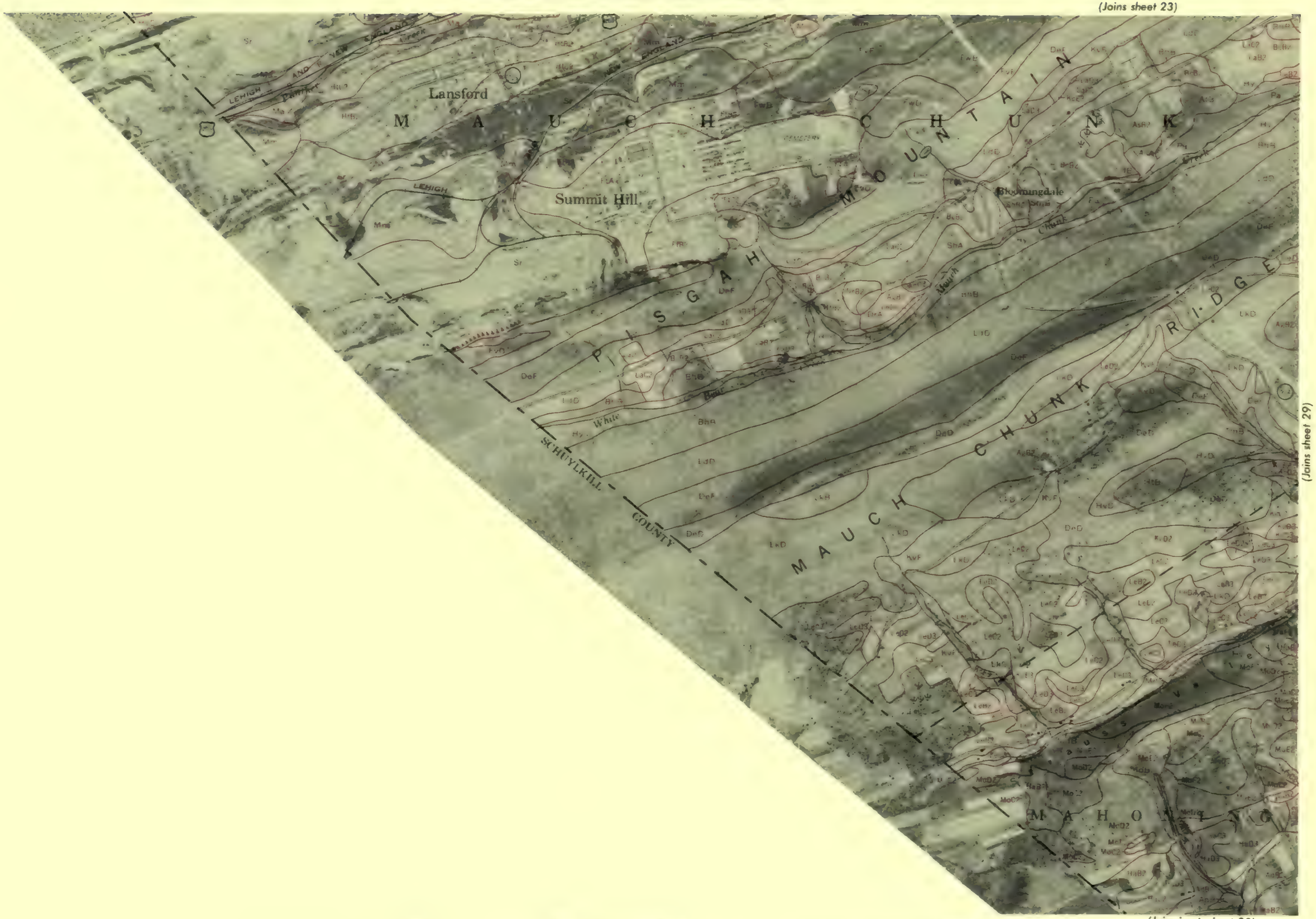
N

Scale 1: 20 000

0 5000 Feet

(Joins sheet 23)

N



(Joins sheet 29)

(Joins inset, sheet 33)

0 ½ 1 Mile Scale 1 20 000 0 5000 Feet


(Joins sheet 24)
29
N
MAUCH CHUNK RIDGE
M A U C H C H U N K
Mertz Town
Pleasant Corners
M A H O N I N G
New Mahoning
Normal Square
M A H O N I N G
E A S T P E N N
(Joins sheet 28)
(Joins sheet 30)
(Joins sheet 33)

30

N

(Joins sheet 25)

(Joins sheet 29)

(Joins sheet 31)

(Joins sheet 34)

0 ½ 1 Mile

Scale 1:20 000

0 5000 Feet

(Joins sheet 26)

(Joins sheet 30)

(Joins sheet 32)

(Joins sheet 35)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

32

(Joins sheet 27)

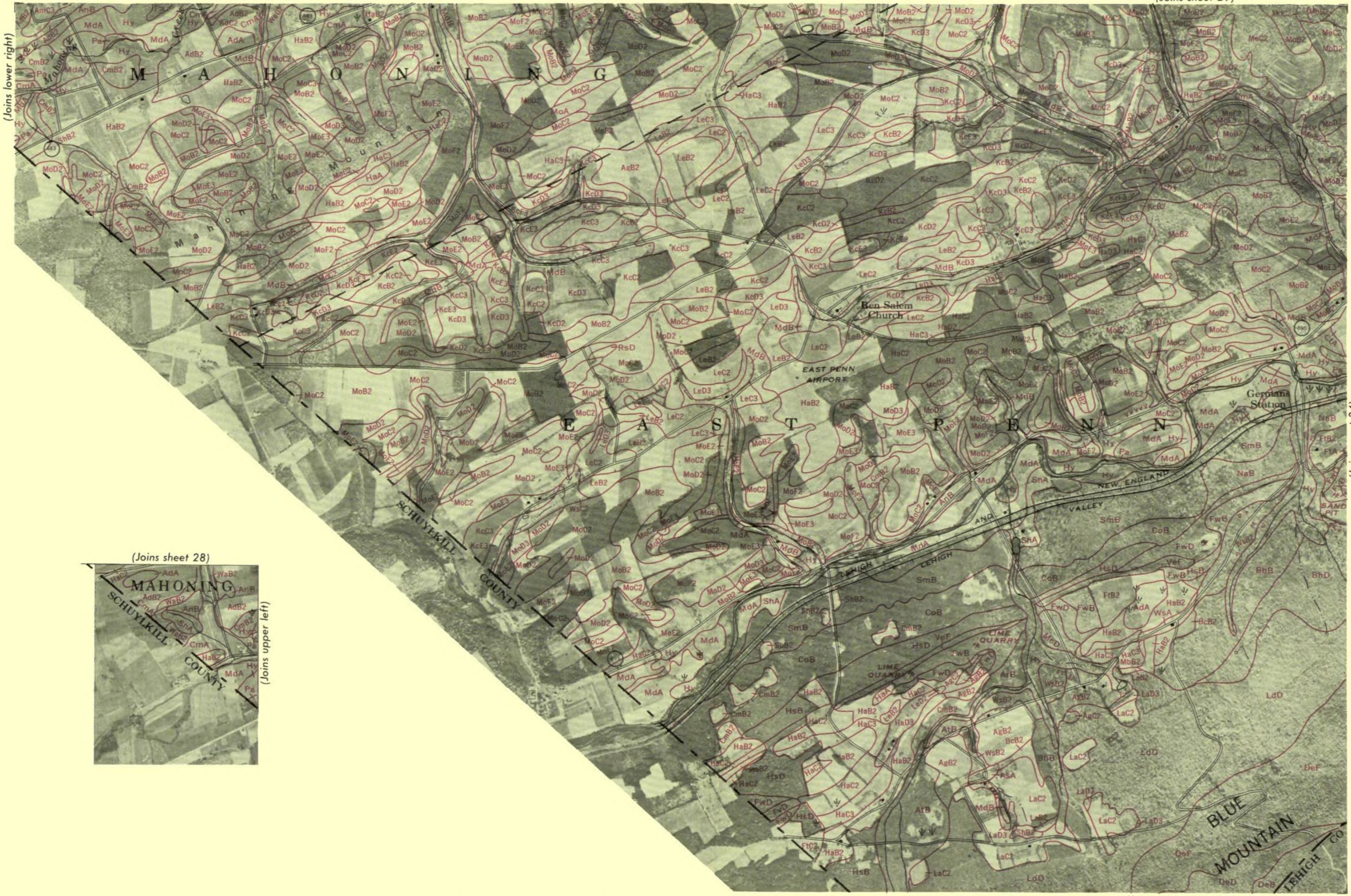
N

(Joins sheet 31)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

(Joins sheet 29)

(Joins lower right)



(Joins sheet 34)

(Joins sheet 28)

(Joins upper left)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

(Joins inset, sheet 35)

(Joins sheet 30)

N

(Joins sheet 33)

(Joins sheet 35)

Ashfield

Fenstermachers

Lehigh Furnace Gap

Bake Oven Knob

Stony Ridge

Scale 1: 20 000

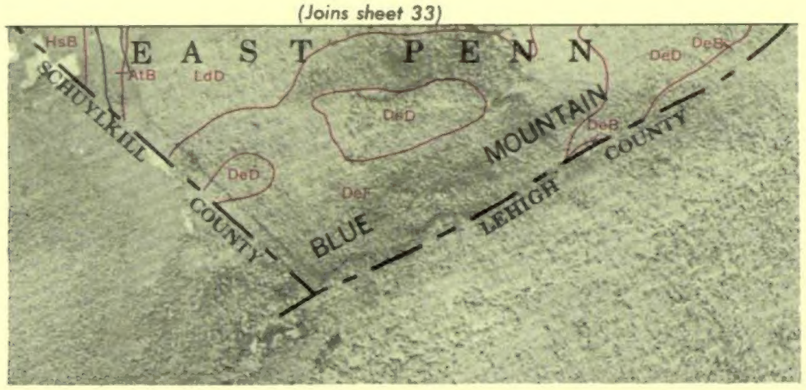
0 ½ 1 Mile

0 5000 Feet

(Joins sheet 31)

(Joins sheet 34)

(Joins sheet 33)



0 ½ 1 Mile Scale 1:20 000 0 5000 Feet